THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CXI. No. 2462.] LONDON, JULY 19, 1910. [62ND YEAR. PRICE 6d.

PARKER & LESTER, ORMSIDE STREET, LONDON, S.E.
Manufacturers and Contractors. Established 1830.

THE ONLY MAKERS OF
PATENT ANTIMONY PAINT & PARKER'S IMPERIAL BLACK VARNISH,
OXIDE PAINTS, OILS, AND GENERAL STORES, FOR GAS AND WATER WORKS.
GOODMAN SAFETY GAS-MAIN STOPPERS, for Shutting off Gas in Mains temporarily during Alterations and Repairs.
GAS-LEAK INDICATORS, *With all Latest Improvements.* Short's Improved and Ansell Clock Form.
For GROUND USE, FLUSH BOXES, &c. For PURIFIER BLOW-OFF VALVES.

LUX'S PURIFYING MATERIAL.
This Material is now successfully used and highly appreciated in many Gas-Works in England and Scotland.
FRIEDRICH LUX, Ludwigshafen-am-Rhein.
Sole Agents for England, Ireland, Wales, & Colonies: T. DUXBURY & CO., 6, Grosvenor Chambers, MANCHESTER.
Tel.: "DARWINIAN, MANCHESTER." 'Phone 1806 City; Tel.: "DUXBURYITE, LONDON." 'Phone 4026 City.
Sole Agent for Scotland: DANIEL MACFIE, 1, North Saint Andrew Street, EDINBURGH. Telegrams:
Descriptive Pamphlet on Application. "GASLUX, EDINBURGH."

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE, LIMITED,
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.
Manufacturers of GAS RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.
LONDON OFFICE: E. C. BROWN & Co., LEADENHALL CHAMBERS, 4, ST. MARY AXE, E.C.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
NEWTONGRANGE, MIDLOTHIAN.

CAST IRON PIPES FOR GAS OR WATER.
Telegrams: "AMOUR, LONDON."
Telephone Nos.: 1890 HOLBORN; CENTRAL 194.
A. G. CLOAKE,
54, HOLBORN VIADUCT, LONDON, E.C.

FOR Disposal of **CONDEMNED & DISUSED GAS METERS & TIN SCRAP CUTTINGS,**
Apply to THE LONDON ELECTRON WORKS COMPANY, LIMITED,
Telegrams: "Stannum, London." Metallurgical and Detinning Works, REGENT'S DOCK, LIMEHOUSE, LONDON, E. Telephones: 1820, 1821 (2 lines), East.

"MELDRUM"
LOW GRATE
BREEZE FURNACE.

High Efficiency.
Reduced Prices.

Recently supplied to 26 Gas-Works.
(16 Repeat Orders.)

CANAL WORKS, **TIMPERLEY, MANCHESTER.**

WROT. IRON AND STEEL TUBES, AND FITTINGS OF ALL KINDS.
BRASS AND GUNMETAL FITTINGS.
GAS LIGHT FITTINGS OF ALL STYLES AND DESIGN.

TRADE MARK.

JOHN RUSSELL & CO., LTD.

WORKS:
Alma Tube Works, WALSALL;
Belmont Brass Works, BIRMINGHAM.

WAREHOUSES:—LEEDS—15, Wellington Street.
BRISTOL—6, 8, & 10, Colston Street. MANCHESTER—London Road.
LONDON—145, Queen Victoria Street, E.C.; 150, Charing Cross Road, W.C.;
58, Commercial Street, Spitalfields, E.; 43 & 45, Newington Butts, S.E.

Telegrams: "COCKEYS, FROME."

EDWARD COCKEY & SONS, LTD.,

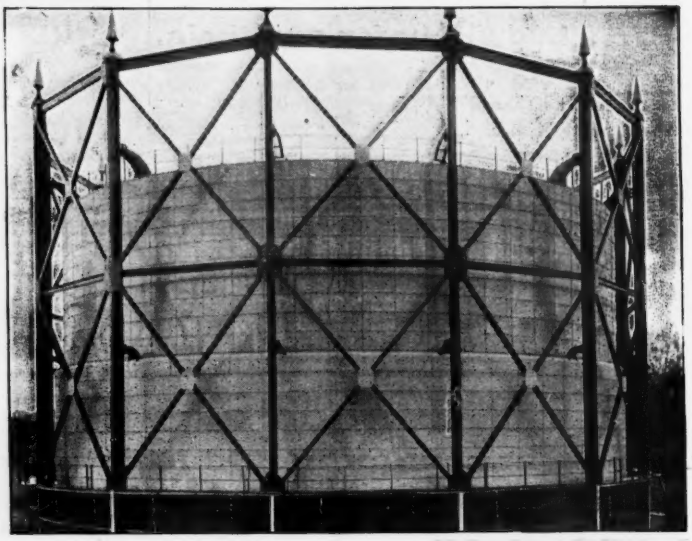
Telegrams: "DAMPER, LONDON."

GASHOLDERS IN EITHER STEEL OR WROUGHT IRON.
GASHOLDER TANKS IN STEEL, WROUGHT OR CAST IRON.

CAST-IRON COLUMNS.

STEEL or WROUGHT IRON STANDARDS.
(Any Section.)

INLET and OUTLET PIPES in either CAST or WROUGHT IRON, or STEEL.



HYDRAULIC MAINS.
FOUL MAINS.
CONDENSERS.
RETORT-LIDS.
PURIFIERS.
HYDRAULIC LIFTS.
ROOFS.
BOILERS in either WROUGHT IRON or STEEL.

LAMP COLUMNS, MAIN PIPES, and IRREGULARS always in Stock.

THE IRON-WORKS, FROME, SOMERSET.

London Office: 181, QUEEN VICTORIA STREET, E.C. *BALE & HARDY, Agents.*

SAML. CUTLER & SONS, MILLWALL, LONDON,

And at 39, VICTORIA STREET, WESTMINSTER, S.W.

CARBURETTED WATER-GAS PLANT.

MAXIMUM EFFICIENCY GUARANTEED.

Inspection of Working Plants Invited.

No. 221.

THE BARROWFIELD IRON-WORKS, LIMITED,

GAS ENGINEERS & CONTRACTORS,

Telegrams: "GASOMETER GLASGOW."

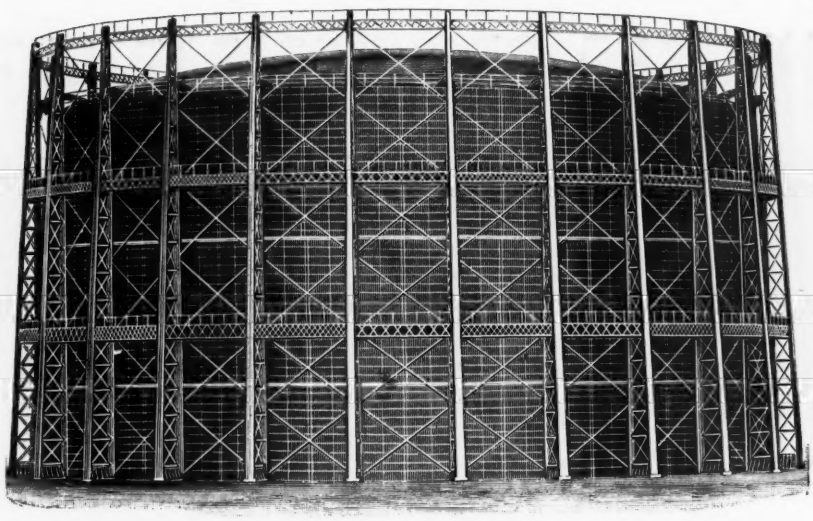
GLASGOW.

OIL PLANT AND CHEMICAL APPARATUS.

BRIDGES, GIRDERS, WHARVES, PIERS.

ROOFING OF EVERY STYLE.

PIPES, VALVES, AND CONNECTIONS.



GAS APPARATUS OF EVERY DESCRIPTION.

RETORTS, CONDENSERS, SCRUBBERS, PURIFIERS.

GASHOLDERS AND TANKS.

ENGINES, EXHAUSTERS, STEAM BOILERS AND FITTINGS.

Three-Lift Gasholder. Capacity, Six Million cubic feet.
240 feet Diameter by 45 feet deep each Lift. Erected at Glasgow.

London Office: 6, LITTLE BUSH LANE, CANNON STREET.

LIGHTING UP SEASON.

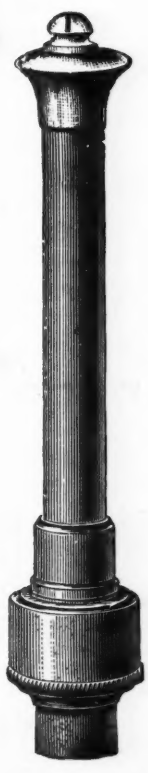
Orme's Regulators

FOR

Ordinary

AND

Incandescent Gas Lighting.



Any Make of Regulators Repaired with Promptness and Despatch.

All information and prices—

GEORGE ORME & CO.,

Atlas Meter Works,

OLDHAM.

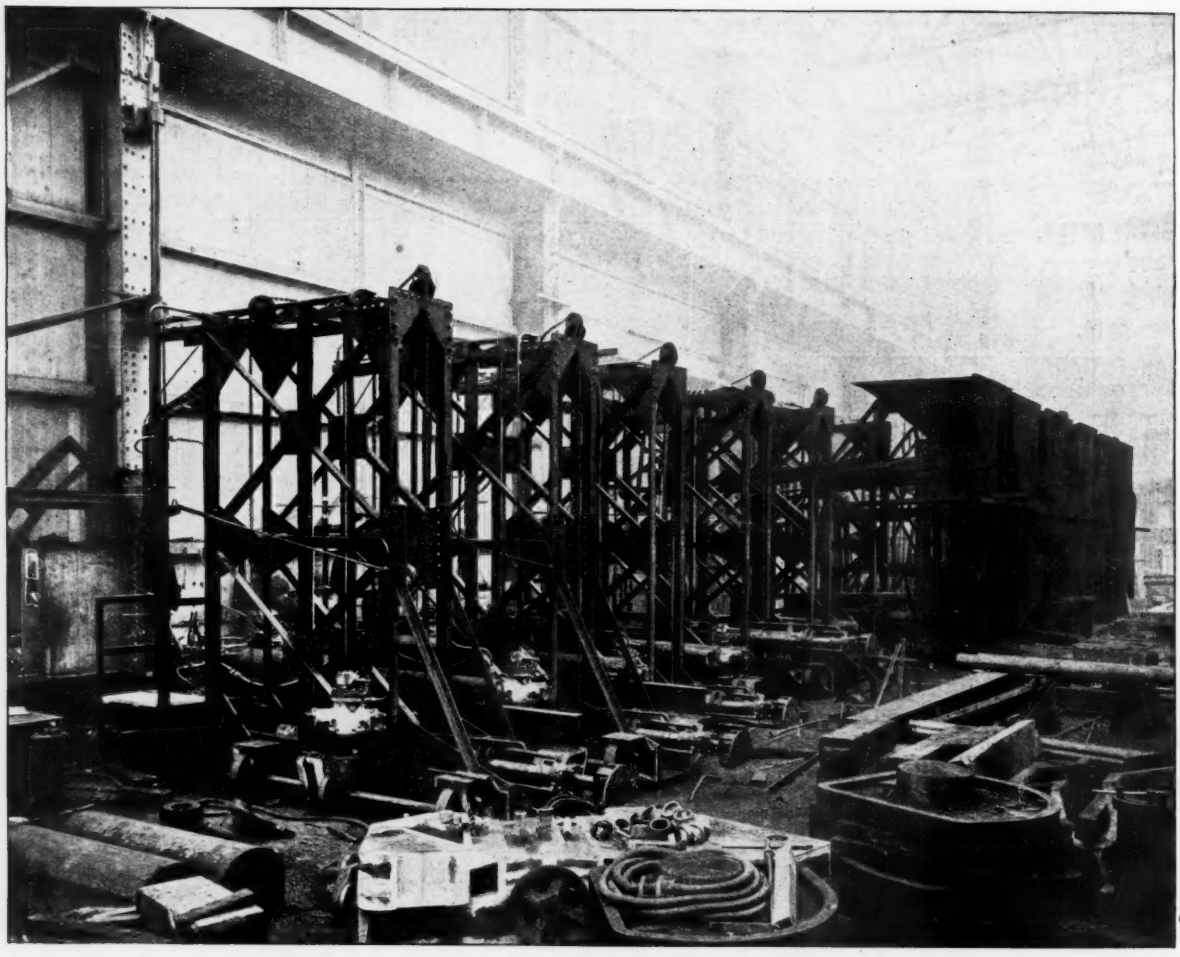
Telegrams: "ORME OLDHAM."
Telephone No. 93.

ARROL-FOULIS

PATENT HYDRAULIC MACHINERY

FOR

CHARGING AND DRAWING GAS-RETORTS.



SIX 20 ft. THROUGH RETORT HUNTER-BARNETT PATENT COKE PUSHERS, and

SIX ARROL-FOULIS PATENT CHARGING MACHINES capable of charging up to Six cwt. per Mouthpiece.

PART ORDER OF TWENTY-TWO MACHINES

For the **South Metropolitan Gas Co.,** presently in hand.

SOLE MAKERS:

SIR WILLIAM ARROL & CO., LIMITED,

85, PRESTON STREET, GLASGOW.

FOR FULL PARTICULARS APPLY TO THIS ADDRESS.

FIRST. **"NICO"** BEST.

No. 4.
Standard "Large" Size.
75-candle power.

The **ORIGINAL** Inverted Burners and Mantles
ARE NOW SUPPLIED
Complete with "NICO" Patent Gas Regulators.

LEADING LINES.

ARTISTIC
and
ECONOMICAL.

EFFICIENCY
combined with
DURABILITY.

THE NEW MEDIUM SIZE.

No. 6.
Medium Size.
55-candle power.

No. 5.
Bijou Size.
30-candle power.

"NICO"
BURNERS are used and recommended by all leading Gas Companies.

"NICO"
MANTLES are unrivalled for Brilliancy and Durability.

THE NEW INVERTED INCANDESCENT GAS LAMP CO., LD.

19 & 23, Farringdon Avenue, London, E.C.

Telephone: Nos. 2680 and 2681 HOLBORN. Telegrams: "VALIDNESS."

ASHMORE, BENSON, PEASE & CO., LTD.,

STOCKTON-ON-TEES. Telegrams: "GASHOLDER."

London Office: 39, Victoria Street, Westminster, S.W.

MANUFACTURERS AND ERECTORS OF

Gasholders, Purifiers, Condensers, Washers, Steel Mains, Roofs,
AND ALL OTHER GAS-WORKS PLANT.

JOSEPH EVANS & SONS, (WOLVERHAMPTON) LTD.

CULWELL WORKS, WOLVERHAMPTON.

Telegrams: "EVANS, WOLVERHAMPTON." London Address: Salisbury House, London Wall, London, E.C. National Telephone: No. 39.

12,000 PUMPS IN STOCK AND PROGRESS.

Please apply for Catalogue No. 8.

TRADE MARK.

Fig. 705. "SINGLE RAM" STEAM-PUMP.

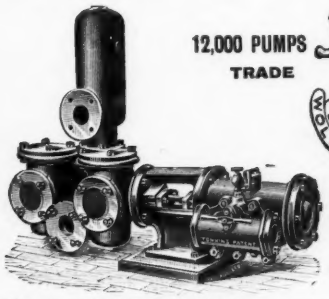


Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

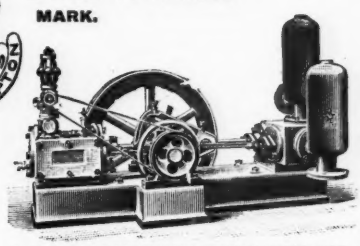


Fig. 685. "RELIABLE" STEAM PUMP FOR TAR AND THICK FLUIDS.

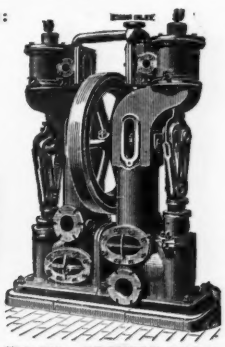


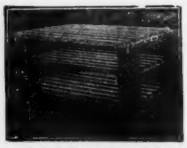
Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

KIRKHAM, HULETT & CHANDLER, LD., 132 & 133, Palace Chambers, WESTMINSTER, S.W.

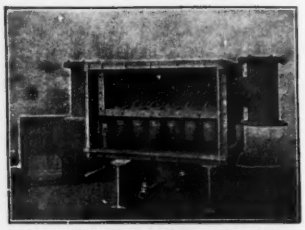
"Standard" Specialties.

WASHER-SCRUBBER.

"HURDLE" GRIDS.



"RACK" GRIDS.



TAR & NAPHTHALENE WASHER.

Wrought-Iron

And Fittings & Accessories.

LAMBERT BROS. (WALSALL), LTD.

Alpha Works, WALSALL.

MANUFACTURERS OF

WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM.

BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES TOOLS, &c.

LONDON: LAMBETH BRASS & IRON CO., LTD., 91 & 93, SOUTHWARK ST., S.E.

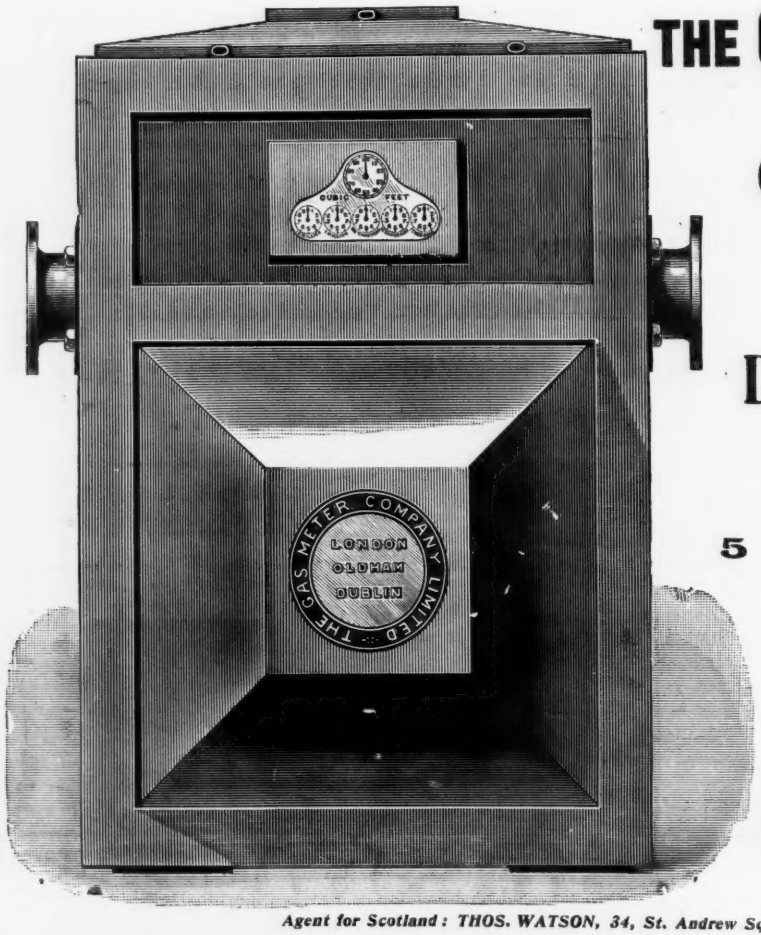
HARDMAN & HOLDEN, LTD. MANCHESTER.

Telegraphic Addresses:
"BENZOLE, MANCHESTER."
"BENZOLE, BLACKBURN."
"OXIDE, MANCHESTER."

Telephone Numbers:
Head Office, 1112 Manchester.
Works Dept., 2397 Manchester.
Oxide and Laboratory, 2369 Manchester.
Blackburn, 295 Blackburn.
Clayton, 2397A Manchester.

All Bye-Products from the Distillation of Coal dealt with.

SPECIALITIES { Hydrated Oxide of Iron for Gas Purification, and of different Strengths to suit conditions of Purification, Sulphuric Acid (free from Arsenic) for Sulphate of Ammonia Manufacture, Recovered Sulphur, and Prussiates of Soda, Spent Oxide bought on Sulphur and Cyanide Contents, Tar and Gas Liquor purchased. *See our Advertisement last week.*



THE GAS METER CO., LIMITED.

CROLL'S PATENT IMPROVED DRY GAS-METERS.

ALL SIZES IN STOCK.

5 Years' Guarantee.

For Prices and Particulars apply to—

WORKS: 238, KINGSLAND ROAD, LONDON;
UNION STREET, OLDHAM;
HANOVER STREET, DUBLIN;
18, ATKINSON ST., MANCHESTER.

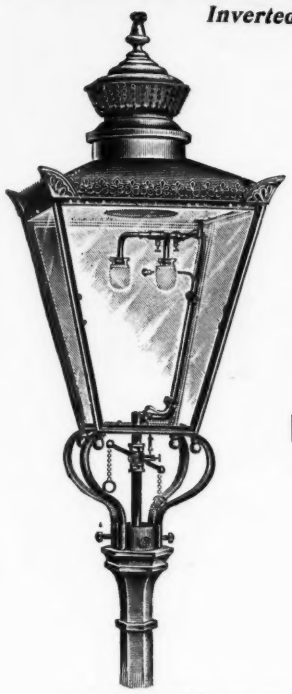
Telegraphic Addresses: "METER LONDON." "METER OLDHAM." "METER DUBLIN." "METER MANCHESTER."

Telephone Nos. 142 DALSTON (National). 340 OLDHAM (National). 1995 DUBLIN (National). 2918 MANCHESTER (National).

Agent for Scotland: THOS. WATSON, 34, St. Andrew Square, EDINBURGH.

STREET LIGHTING.

CONVERSIONS



Inverted Adaptations to fit any Size Lantern.

MAXIMUM LIGHT
FOR A
MINIMUM CONSUMPTION.

ANGLE BURNERS.

NO INNER CHIMNEYS OR GLOBES REQUIRED.

Samples for Trial on Application.

Write at once for Particulars and Prices to—

MOFFAT'S LIMITED,
13, FARRINGDON ROAD, LONDON, E.C.

Test it for yourself!

We will send on approval to any Gas-Works Engineer a Governor for test and approval. One well-known Company say the FOSTER is undoubtedly the finest Gas Governor made. It is also the smallest.

FOSTER GAS GOVERNOR

has an original and very simple valve system that is sensitive to the slightest variation in main pressure and only permits gas at correct pressure to be delivered to the house service. Not only does this mean a great saving in gas consumption, often 40 per cent., but better light from mantles and a greater and uniform heat from Gas Fires and Cookers.

Simple, safe, inexpensive, never needs attention.

WRITE TO-DAY FOR LIST.

FOSTER ARC LAMP & ENG. CO., Ltd.,
Works: Wimbledon, LONDON.

"LUX"

Gas Purifying Material.

Further Reduction in Cost of Gas Purification.

TRY IT.

Purifier changes are less by over one-half when using "LUX" as compared with Bog Ore, and it requires considerably less turning than Bog Ore for revivification.

As a labour saver, this speaks for itself, but in addition there is lessened risk, worry, and anxiety for the management.

"LUX" is easily charged with Sulphur 55/60%. Once used, always used, is the verdict of many Gas Engineers in this country who have tried it during the past 18 months.

Descriptive Circular and Laboratory Sample free on Application.

WRITE FOR PRICES.

SOLE AGENTS for England, Wales, and the Colonies—

THOS. DUXBURY & CO., 16, DEANSGATE, MANCHESTER.

Telegrams { "DARWINIAN MANCHESTER." "DUXBURYITE LONDON." }

Telephones { 1806 CITY MANCHESTER. 4026 CITY LONDON. }

HUMPHREYS & GLASGOW

AND

The United Gas Improvement Co., U.S.A.

CARBURETTED WATER GAS PLANT

NINE REASONS—

1. **LOW CAPITAL COST,**
2. **Small Ground Space,**
3. **Control of Coke Market,**
4. **Independence of Coal and Labour,**
5. **Calorific and Illuminating Control,**
6. **Small Sulphur Content,**
7. **Freedom from Naphthalene,**
8. **Instant Production instead of Expensive Storage,**
9. **CHEAPER AND BETTER GAS,**

AND THE RESULT:

Humphreys & Glasgow **233,000,000** Cubic Feet Daily.

The U.G.I.Co., U.S.A. **602,100,000** Cubic Feet Daily.

TOTAL CONSTRUCTION 835,100,000 CUBIC FEET DAILY.

36 & 38, VICTORIA STREET, LONDON, S.W.

Bureau de Bruxelles, 209, Chaussee d'Ixelles.

CONTENTS.

EDITORIAL NOTES.

GAS, &c.—

Victory of the New Standard Burner . . . 169
Interaction of Methane and Ammonia in Presence of Carbon 170
Standardization by Individual Gas Undertakings 170
Rooted Prejudice—A Protest 171
Paving the Way in Canada 172
A Diagram and Two Observations—The Competitors of the Coalite Company—More Municipal Gas-Works Results—A Cool Request—An Association of Consulting Engineers 173

Gas Stock and Share Market 174
Electricity Supply Memoranda. 174
Notes from Westminster 176
Standardization of Stove Parts by Gas Undertakings 177
Personal and Obituary 178
Belfast Gas Managership 178
The Quality of London Gas in the Year 1909 179
Two Paris Gas-Works 182
Association of Consulting Engineers—A New Organization. 185
Examination in "Gas Supply," Third Year—Answers to the Questions Set 186
Promotion of the Sale of Gas 188
Light Distribution in Various Directions . . 189
Regulating the Air Supply to Generators. . 190
Further Studies in Coal Carbonization . . 191
Illuminating Power and Calorific Value of Gas in Canada—Report to the Canadian Gas Association. 196
Heating Bakers' Ovens by Gas 197
Dangers of Mixed Gas and Electricity Appliances 198

REGISTER OF PATENTS.

Automatically Turning On and Off Gas-Burners—Blake, E. W. 199
Vertical Gas-Retorts—Ewing, W. 199
Coin-Freed Mechanism—Hibberd, C. E.. . 199
Gas Lighting Apparatus for Use in Connection with Life-Saving Apparatus—Williams, T. E., Berger, E., and Burroughs, J. G. . 199
Radiators Heated Directly by Gas—Martin, A. 200
Automatic Gas-Regulators—Williams, G. A. 200
Suspending Gas-Lamps Across Streets—Deutsche Gasglühlicht Aktiengesellschaft. 200
Applications for Letters Patent. 221

CORRESPONDENCE.

The Battle of the Burners 201
Gasholder Tanks with Bulging Sides . . . 201
Handling Hot Coke by Electric Telpher . . 201
How Gas Consumers are Robbed—Further Instructive Illustrations 202

LEGAL INTELLIGENCE.

Property Owners and Water Consumers Liability 202
National Air Gas Company, Limited . . . 202

PARLIAMENTARY INTELLIGENCE.

Progress of Bills 203
Mr. Isaac Carr's Test-Burner Diagram . . 203
Havant Gas Bill 203
Middlesbrough Corporation Bill 203
Liverpool Gas Company and the Burner Bill 204
Gas Companies (Standard Burner) Bills . . 211

MISCELLANEOUS NEWS.

European Gas Company, Limited 214
Devonport Gas-Works 215
Carlisle Gas Profits 216
Darlington Gas Undertaking 216

MISCELLANEOUS NEWS (*continued*)—

Gas Profits at Bury 216
Tipton Gas-Works Results 216
Neath Corporation Gas Undertaking . . . 216
Sowerby Bridge Gas-Works Extensions . . 216
Tyldesley-with-Shakerley Gas Undertaking . 217
A Gas and Water Company in Difficulties . 217
Sheffield Corporation Water Department—Annual Report of the General Manager . 217
Quality of Cambridge Water 217
Notes from Scotland 218
Current Sales of Gas Products 219
Coal Trade Reports 219
Gas Stock and Share List 222

PARAGRAPHS.

The William Young Memorial Lecture Fund—City and Guilds of London Examinations 176
Japan-British Exhibition Awards 177
A Visit to the Glenboig Fire-Clay Works . 181
North British Association of Gas Managers—Long Cast-Iron Water-Pipe 187
Gas and Electricity Supply at Krupp's Works 196
A Reduction at Burton-on-Trent 200
Trading Undertakings at Mansfield—Brixham Gas Company—Reduction in Price at Leek—Explosion at the Oswaldtwistle Gas-Works—Gainsborough Gas Undertaking . 214
Improved Church Lighting at Surbiton—Gas-Works Loans at Tipton 218
Swadlincote Gas Undertaking — Improved Public Lighting at Lowestoft—Good Working at Marple—Reduction in Price at Leek—Charge for Street Lighting at Holsworthy—Cairo Water Supply—Sale of Stocks and Shares. 220
Bucks and Oxon Gas Company—Overlapping Local Authorities 221

GWYNNE & BEALE'S WORLD-RENOWNED

GAS EXHAUSTING MACHINERY.

GWYNNES LTD., ENGINEERS, HAMMERSMITH IRON WORKS, LONDON, W.
81, Cannon Street, E.C.

HEAD, WRIGHTSON & CO., LTD., STOCKTON-ON-TEES.

MAKERS OF:
ALL KINDS OF GAS PLANT.
RETORT FITTINGS.
CONDENSERS & PURIFIERS.
UNIQUE "MARCUS" SCREENS.
SPIRAL & OTHER GASHOLDERS.
CONVEYORS.

STORAGE TANKS, VALVES, &c.
SCHANDLER'S PATENT (SURFACE & SHOWER)
ROTARY WASHER SCRUBBER.
ELEVATORS & BUNKERS.
ENTIRE STEEL STRUCTURES.
NEAT CASTINGS, ANY SIZE.
SCREEN

London Office:
5, VICTORIA ST., WESTMINSTER, S.W.

ORIGINAL MAKERS.

ESTABLISHED 1844.

GUARANTEED 5 YEARS.

THOMAS GLOVER

& CO., LTD.,

GOTHIC WORKS, ANGEL RD.,
EDMONTON, LONDON, N.

BRANCHES:

Manchester, Birmingham, Glasgow,
Falkirk, Belfast, and Melbourne.

PARKINSON'S

PREPAYMENT METERS

For Pence, Shillings, or any Coin.

Can be fitted with

COLSON'S PATENT CASH-BOX.

SIMPLICITY . .
DURABILITY . . } COMBINED.
EFFECTIVENESS

PARKINSON AND W. & B. COWAN, LTD.
(Parkinson Branch),

COTTAGE LANE, CITY ROAD, LONDON. | BELL BARN ROAD, BIRMINGHAM. | HILL STREET, BELFAST.

JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXI., No. 2462.—TUESDAY, JULY 19, 1910.

EDITORIAL NOTES—GAS, &c.

Victory of the New Standard Burner.

THE back of all opposition to the application of the "Metropolitan" No. 2 burner for the testing of gas has been broken by the sweeping and unanimous decision, in favour of the Standard Burner Bills Nos. 1, 2, and 3, of the Committee over whom Sir Henry Kimber has been so ably presiding—a decision that has only been arrived at after a most patient and impartial hearing of all parties, after a critical examination of all contention, and after the application of a broad commonsense to the interpretation of parliamentary intention, and to the determination of the practical issues involved. In the course of the case, the Chairman asked that credit might be given to the Committee for attempting to understand the questions surrounding the change of test-burner; and the decision indeed reflects and concentrates the complete success of the Committee's endeavour to grasp the truth from the complex mass of testimony presented to them. The Chairman did not satisfy himself with merely a formal announcement as to the conclusion at which the Committee had arrived; he gave sound, logical reason for their determinations. And in the comparatively few sentences comprising the decision, there is an inestimable weight of value to the gas industry—a value immensely greater than that of the hundreds of printed pages composing the minutes of evidence and counsel's speeches. After the time expended by both Houses this session upon the question, after the unqualified verdict in favour of the new burner by the House of Lords, and after the judgment of Sir Henry Kimber's Committee with the statement of motives for not imposing any special terms on the change of burner, any hope that future opponents may harbour—if there should be any more (which we much doubt)—of defeating the application of the "Metropolitan" No. 2, or of securing concession as the result of its application, will indeed be built on quicksand. The result has shown that those local authorities who regarded as irrevocable the repeated declarations of Parliament and the Board of Trade regarding the new burner were as wise as the others were foolish—foolish in not accepting the clearly expressed and oft-confirmed parliamentary policy in this matter, and foolish in making a fresh effort to place obstruction in the path of the progress of the gas industry.

The alternative requests of the opponents were the retention of the present test-burners, on the ground that any change would inflict some financial disadvantage upon the consumers of gas; or, in the event of the change of burner being granted, the raising of the nominal candle power, or the bestowal upon the consumers of some definite monetary consideration (through the reduction of standard price or other means) as compensation for the hypothetical losses they would sustain—losses that have not been discovered in practice wherever the new burner has been applied during the past five years or so. As to the retention of existing standards, the opponents' contention was for the perpetuation of a defective burner so as to secure inflated candles, instead of an alteration to an accurate burner giving normal candles. The proposal as to the raising of the nominal candle power was so quixotic that the technical witnesses for the opposition had little (or we think it would be more correct to say "nothing") to urge on the subject, leaving the fantastic idea to be borne solely by counsel. And as to the question of compensation, the Committee's views followed very much the lines of argument time and again presented in these columns. Parliament has never recognized any finality in the test-burner; but Parliament has acknowledged the right of gas suppliers to the substitution by greater perfection of proved defect in the test-burner, and that without even hinting at any special financial consideration accompanying the change.

Let us quote what Sir Henry (in the words we trace the large legal and commercial training of his mind) had to say, on behalf of the Committee, upon these particular and cardinal points: "The burners hitherto in use have been defective. The "burner proposed to be established as the standard burner "is, if not perfect, yet as perfect as is at present known for "achieving the object of Parliament in giving what Parliament certainly intended to give—that is, a light equal to "the light of so many candles." Then as to the contention that the consumers ought to be compensated, the Committee, said Sir Henry, "are unanimously unable to see that, and "to recognize that the fact of the burner, which was supposed to be perfect, and has been found to be imperfect—"having perhaps done a wrong to somebody in practice—"gives any right to compensation further than the legislation applicable to gas companies will automatically give." In addition to which, there is the cheapness insisted upon by exceeding active competition. Even in respect of the Mersey Docks and Harbour Board, who are extensive customers of the Liverpool United Gas Company, the Committee considered the fears of that body would, in practice, be found to be exaggerated, and that any loss and inconvenience they may sustain will be practically compensated by the reduction of price which may be expected from the Company. And so the whole of the opposed Companies—including the Liverpool Company—have obtained, if the Bills now go through the third reading without further challenge (we hardly think that any additional molestation is likely after what happened on second reading, and after the exhaustive inquiry in the Committee rooms), the new test-burner, and what is of no small importance unconditionally. It is a great and an important win for the gas industry—an industry that requires in these competitive times more freedom; and there will be throughout, save in perhaps two places, considerable satisfaction over it. There were some who thought the Liverpool Gas Company would not get through unscathed; there were others who were of the converse opinion. We were among the latter; for if there was a Company who had a right to the removal of defect by something of greater perfection, it was the Company with a high-grade gas and a flat-flame burner as a standard. Between this Company and the others, if there had been any need for discrimination, it should certainly have been in favour of the former.

The fight this session for the standard burner has been a big one—well fought by the promoters, and tenaciously by the opponents. But the latter suffered from many weaknesses, not the least of which was that the constituents of their case absolutely declined to synthetize. They were claimants, too, for the righting of some hypothetical injustice to the consumers, but professed to be wholly oblivious to any grounds on which the claims rested for the rectification of an existing positive injustice to gas suppliers. But it is all at an end; and we anticipate that the Bills will now move forward formally to the Royal Assent. The fight, however, that has taken place will leave behind something more than the right on the part of a number of gas companies to a change of test-burner. Sir Henry Kimber is of opinion that it will form an important step towards the revision of general legislation referring to gas undertakings. We think he is right. It cannot, for instance, be many years before the question of a standard calorific test comes prominently to the front in substitution for the standard illuminating power one. There was an attempt on the consideration of clauses to get a calorific power test inserted in the Bills; but the Committee were immovable in their view that such a test was not germane to the measures before them. Clauses brought up by certain local authorities (who happen to be electricity suppliers) sought to impose upon the companies additional burdens; but the attempt met with its desert of ignominious failure. If the prognostication of the Chairman should prove to be true, as to the revision of general legislation relating to gas undertakings, it must, as an indispensable condition, be prefaced by an inquiry by a competent Committee, when it should also be considered

whether local bodies who are competitors in business are proper controlling authorities, and fit and unprejudiced representatives of the public, in relation to private gas enterprise. We have a growing feeling that they are not; and their attitude over the standard burner question has not done anything to temper that feeling.

Interaction of Methane and Ammonia in the Presence of Carbon.

THE recently published annual report of the Chief Alkali Inspector, to some portions of which reference was made last week, contains a further instalment of the "Studies in "Coal Carbonization" carried out by Mr. Forbes Carpenter and Mr. Linder, dealing more especially with the interaction of methane and ammonia in presence of carbon. The results are of great interest; and these are published at length in another part of the present issue of the "JOURNAL." It is a matter for congratulation that, contrary to his expectation when writing the 1908 report, Mr. Carpenter has been able to make opportunity for the continuation of the work; and much gratitude to him for this further contribution will be felt by all concerned in carbonization. We may perhaps express the hope that although, owing to his retirement, no further Alkali Act reports will come from Mr. Carpenter's pen, he may still be able to continue his researches.

It will be remembered that this particular investigation had its origin in the somewhat unexpected observation that, in the Woodall-Duckham continuous vertical retort, the yield of hydrocyanic acid is much higher than is the case with the Bueb intermittent vertical retort, and is approximately the same as that observed with high temperature carbonization in horizontal retorts. This has since been confirmed by tests made with the Glover-West continuous retorts. The suggestion was offered to Mr. Carpenter that the increased yield of hydrocyanic acid in the continuous retort might be due possibly to the action of ammonia on methane, as well as on incandescent carbon, and the investigation was carried out with the object of ascertaining how far this supposition could be supported by experimental evidence. The method adopted was to pass coal gas freed from all hydrocarbons but methane, mixed with varying quantities of ammonia, through a heated tube containing either broken porcelain or wood charcoal, under varying conditions of temperature, and at different rates of flow, and determine in this way the amounts of ammonia respectively decomposed into its elements, converted into hydrocyanic acid, and left unchanged. In the first series of tests, described in the previous report, the relative amounts of methane respectively decomposed into its elements, oxidized to carbon monoxide and carbon dioxide, and left unchanged, were also determined. In the experiments described in the present report, no further tests have been made with porcelain, as the first series showed that this material effects considerable oxidation of the hydrocarbons, ammonia, and hydrocyanic acid at temperatures above 800° C. Determination of the fate of the methane had also to be omitted from lack of time.

In the limits of a short review, it is impossible to deal with all the important observations here made; but, broadly speaking, the experimental results lead to the conclusion that the hydrocyanic acid found in crude coal gas obtained under ordinary gas-works conditions is mainly the product of a reversible reaction between the ammonia and the incandescent carbon, but that secondary reactions occur in which both ammonia and hydrocyanic acid are decomposed into their elements. Even the last-named reactions appear to be reversible to some extent, as certain of the experiments showed a small but distinct increase in the amounts of ammonia and hydrocyanic acid, due apparently to the synthesis of these bodies from their elements. Hydrocyanic acid, however, when once formed, appears to undergo only slight decomposition at temperatures below 1000° C., whereas ammonia undergoes rapid dissociation at much lower temperatures. It was further found that the presence of methane is favourable, though not essential, to a high production of hydrocyanic acid. But as the hydrocarbon yields carbon at temperatures below 755° C., and hydrocyanic acid does not appear until a higher temperature than this, it is doubtful whether the increased yield is due to a direct interaction of the ammonia and methane, or to the action of the former on the freshly-formed carbon due to the thermal decomposition of the methane. Experiments made with addition of ethylene to the gas showed that this hydrocarbon was still more favourable to the production of hydrocyanic acid. Both methane and ethylene also lessen the amount of ammonia decomposed into its elements; this being probably due to the dilution brought about by the decomposition of these gases—the amount of hydrogen formed from them being greater than that of the original hydrocarbon. Another interesting observation is that the activity of the wood charcoal decreases with use, owing apparently to the surface becoming coated with a film of graphitic carbon from the decomposition of the methane, the catalytic action of which is more sluggish than that of the wood charcoal, and it is most probably this form of carbon which is present in the coke in the retorts during carbonization.

Messrs. Carpenter and Linder fully realize that it is not permissible to assume that, in the actual carbonization of the coal in retorts and ovens, the reactions necessarily proceed in the same manner as in their experiments; the conditions in many respects being very different. Probably the continuous vertical retorts present the nearest approach to their experimental conditions; but even here great differences exist, notably in the variation of temperature at different zones in the retort, and also in the presence of many other substances such as tar vapours and the steam formed from the combined oxygen of the coal. The ammonia itself may be produced in many ways—such as by the action of nascent hydrogen, the direct thermal decomposition of the nitrogenous substances, and even by the action of steam or hydrogen on the hydrocyanic acid. And, in addition to the formation of the latter as a secondary product from the ammonia, it may possibly also be produced by the direct thermal decomposition of the nitrogenous substances of the coal at relatively low temperatures. Indeed, it seems difficult to account in any other way for the presence of hydrocyanic acid in the ammoniacal liquor obtained from coalite gas, as here the temperature to which the coal is subjected is stated never to exceed 850° Fahr. or 454° C., and the lower temperature limit of its production by the interaction of ammonia and carbon or hydrocarbons is found by Messrs. Carpenter and Linder to be more than 250° C. above this temperature.

Standardization by Individual Gas Undertakings.

STANDARDIZATION has its uses and its abuses. There is a point in it up to which there is an accretion of economy, convenience, and efficiency; but beyond that point there may be a wasting away of advantages to the complete vanishing point. We are afraid there are gas undertakings that are going beyond really prudent bounds in standardization at the present time in connection with stoves, and that, by setting up individual standards for apparatus of their own, are working not only against their own interests, but against those of the gas industry generally. We have advocated and commended all work on the part of stove manufacturers that has had for its object the standardization of their own parts, in order to effect interchangeability between one gas-stove and another (equal in size) of their make, with the object of reducing the number of parts to be kept in stock by gas undertakings, and so make maintenance a matter of greater economy. There are not many makers of gas-stoves in the gas industry; and standardization by them individually is an important step towards realizing the economy and conveniences that are growing more and more desirable with the large expansion of the gas cooking and heating business. But what is now being done—true to only a limited extent at present—by gas undertakings is over-riding the limits of practicability and common advantage.

The interests of the gas suppliers and of the gas-stove makers are reciprocal. To both, it is a matter of importance that gas-heating appliances should, consistently with efficiency, quality, and appearance, be as cheap as possible; and that the cost of upkeep should be as low as possible. But when, in working to this latter end, uniformity of type is reduced to special standardization for single gas undertakings, then we cannot help feeling this is going beyond requirement, and is in fact unwise, and that the inevitable result will be the defeat of the desired ends. The adoption of distinctive types by individual gas undertakings cannot be an economical procedure in production either for them or for the gas industry generally. The objections to such a course are several; and they are dealt with in an article elsewhere, as it is important that, at the incipient stages of a disposition on the part of gas undertakings to individualize their own gas apparatus, the matter should be thoroughly discussed and considered in all its practical bearings, in the very interests—those of economy, of convenience, and

of efficiency—that a prudent degree of standardization is well designed to, and will, serve.

But there is a point for the consideration of the manufacturers here. No doubt the comparatively new tendency has had its origin in the difficulty experienced by gas undertakings in, by distributing their patronage among several firms of stove manufacturers, having to stock the parts of each maker for maintenance purposes; and it is a point for the consideration of the stove manufacturers whether in the growing desire for interchangeability by gas undertakings to effect economy, the tendency will not be to (as an alternative to individual standardization by the latter) individual patronage and long contracts, although the objection to this would be that it would largely rule-out the benefits to the gas concerns of competition. On the other hand, we cannot expect, and should not advise (subject to change of view on further argument), any effort being made to bring about standardization and interchangeability as between maker and maker, as such a proceeding would only be obstructive to individual endeavour on the part of firms, and therefore to development of the various essential qualities of a gas cooking or heating stove. For these purposes, it is necessary there should be an open field, and not one hedged in by the rigid limitations of a universal standardization. We ask gas undertakings not to do anything towards contributing to a condition of things that must circumscribe effort and energy and discourage advance, so long as the individual manufacturers work within their own spheres to meet, by interchangeability in their own makes of similar order, the other requirement of economical maintenance.

Rooted Prejudice—A Protest.

We must protest against the narrow manner in which the inspectors under the Factory and Workshops Acts pursue their duties in regard to the lighting, warming, and ventilating arrangements of the places under their jurisdiction. They seem to be possessed of the one idea that gas is a noxious thing that must be year after year abused, condemned, and got rid of at any cost. We find this all too prevalent spirit once again in the report for 1909 (reviewed recently); and we feel constrained to write in a way that we should not otherwise do in view of the persistence of the attacks that are made, notwithstanding that there is not any definite proof in the report (though we may admit fully the crude conditions under which gas is all too frequently found to be used in factories and workrooms) of any impairment of health or deaths traceable to the particular evils so strongly and so repeatedly emphasized. It seems to be altogether beyond the grasp of some of the inspectors that it is to the misapplication of gas and not to gas itself that they should direct their attention and influences. There is not the slightest reason why gas should not in factories and workshops be applied in a manner—a manner claiming only the consideration of elementary principles, and not the complex and highly technical requirements of electricity—that will be just as free from evil consequences as gas for lighting, heating, and cooking in the home. In gas, the manufacturer has a practical, economical, and convenient means of lighting, of heating in his processes, and of warming for the comfort of his operatives; and all that is wanted in the application of this article of composite utility to the manufacturer is the combination of common-sense. And it is to the securing of this combination that all the inspectors of factories and workshops should alone direct their energies, and not to—consciously or otherwise—doing the gas-supply industry an injustice and an injury in the way they are now doing, to the benefit of a competing industry, which is not slow to take advantage of official reports to the furtherance of their own commercial ends.

We believe that instances are not unknown where there have been recommendations on the part of inspectors for the displacement of gas by the adoption of electricity, when it has happened that the carbonic acid contents of the air of a workroom has been found to have risen a few parts in 10,000—we repeat, in 10,000!—above the limit set as the permissible standard by the department, while the economical change from flat-flame gas-burners to incandescent ones, and an insistence on adequate ventilation (the use of which should not be left to the capricious notions of the workpeople themselves), would have produced the remedy. Certain of the inspectors appear to be animated by the idea that they have only to get rid of one source of carbonic acid (which is relatively unimportant with modern systems of gas lighting), and there will be a complete change. They apparently lose sight of the fact that where there are human beings congregated, as in workrooms of factories, there is another source of carbonic acid, combined with the organic products of respiration, that is far more dangerous to health; and that the substitution of electricity for gas will not produce an improvement in this direction, but will rather accentuate the noxious effects by the removal of gas, unless an efficient means of exhaust ventilation be introduced and kept in proper order. And if this be introduced, then the heat generated by incandescent gas-burners should be—nay, would be—an aid to the system of ventilation rather than otherwise. Probably the inspectors know as well as we do that 1 cubic foot of gas on combustion only yields 0·5 cubic foot of carbonic acid, while a human being gives off about 0·6 cubic foot per hour. Perhaps they will hardly want reminding that Dr. Pettenkofer found that pure carbonic acid in the proportion of 100 parts per 10,000 of air was not injurious to human beings; while 10 parts of carbonic acid, if derived from the respiration or perspiration of human beings, rendered the air unfit for persons to remain in for any length of time. Perhaps, too, they will remember that Dr. Whitelegge himself has stated that, "where carbonic acid gas is present in excess, it is "important merely as an index of the amount of injurious "organic impurity contributed by human exhalations." The inspectors, if they only think over the matter, must see that, if it requires 7 or 8 cubic feet of gas to produce by flat-flame burners the illuminating power that 1 cubic foot will produce now in a modern inverted burner, they have a ready means of showing factory owners how easily they can bring about improvement in the conditions of their operatives and economy for themselves. In the report last year, there was acknowledgment of improved conditions through such substitution.

So far as the work of the inspectors goes in operating against the general use of flat-flame burners in workrooms and factories, in substituting incandescent gas-burners, and in securing proper ventilation of all warming arrangements using gas, and of the gas-heating devices for tools, &c., we are entirely with them. The present report states, regarding the conditions of the atmosphere, that "better results "compared with previous years are noted;" this being due entirely to improved ventilation. It is distinctly shown that where the ventilation is efficient, there is not an excessive amount of carbonic acid in the atmosphere; and there cannot be where there is a constant change of the air proceeding. The Inspector for Dundee indicates how necessary it is for the ventilation to be maintained in efficient order. In his district, in every case where an excess of carbonic acid was found in factories, a second test proved that the means of ventilation were adequate, but out of order, owing to obstruction in shafts and boxes when the first samples were taken. With the dust and material floating about in the air of most factories, there must be accumulations that choke and so enfeeble the provision for ventilation. But this should not be utilized to the disadvantage of gas. All the efforts of the inspectors in producing and maintaining efficient ventilation, and in securing the application of improvements are to be applauded; but we would ask them not to let any repugnance that has had birth through antiquation and crude method be carried to the length of obstructing in their minds a proper recognition of scientific progress. Prejudice born of old conditions can be excesssively blind to new conditions. But it is no part of the duty of public officials whose functions are inspective, advisory, and controlling, and whose services are admittedly desirable and necessary, and of great advantage in many ways, to conduct them in a manner that is unwarranted, and is detrimental to an industry that has an enormous stake in the country. Against this attitude we here protest in the name of statutorily controlled gas industry; and we hope the protest will not go unheeded.

So far as suction and producer gases generally are concerned, they are altogether unidentified with the town-gas industry, and private plants are not subjected to control with regard to purity. The record of such plants, we are afraid, is doing no good to the town-gas industry, so far as factories and workshops are concerned. It is, however, a satisfaction to find that, in respect of the use of town gas in factories and workshops, there has not to be reported the accidents and fatalities that are set against electricity in the report of Mr. Scott Ram, as noticed last week in "Electricity "Supply Memoranda."

Paving the Way in Canada.

THE gas men of Canada are assisting in clearing away the brambles of antiquation and misconception, and preparing the road for the transition from illuminating power to calorific value as the standard of quality for town gas there. The calorific power movement, it will be noticed, is spreading fast geographically. Germany never has paid much attention to illuminating power, and lately has been evincing an increased affection for calorific value. In other Continental countries, the quality that really now matters is being discussed. At home here consideration is being constantly given to it—privately by gas engineers, and publicly more especially by our chemical friends and in the Parliamentary Committee rooms. Our own technical gas organizations, however, have only accorded consideration to the matter through a single paper, and that from America! Nevertheless, in view of the march of events, the gas profession is very closely concerned in the question. The United States has made material progress in effecting the change, though not perhaps in a manner in regard to the standards already fixed that altogether meets with approval here. And now in Canada, the matter has been considered by the Canadian Gas Association, upon a report by a Committee consisting of Messrs. Arthur Hewitt and John Keillor, the last-named of whom Scotland gave to the Dominion in 1906. The data on which the report is based have been compiled in a really painstaking way; and there is no question as to the amount of labour that has been involved in securing the testings of gas of various illuminating powers and of different constitutions to ascertain the relations of candle powers to calorific values, and which relations are proved once again to be altogether indefinite.

There are persons at home who, if they cannot prove the contrary, are in the habit of attempting to disparage by ridicule such estimates as 80 or 90 per cent. of the gas now consumed being applied to purposes other than open-flame lighting. But ridicule standing alone has little negatory value. Here we are in this country positively in a state of seething activity in the development of incandescent gas lighting, and the use of gas for heating, cooking, and industrial purposes; and if what holds good in Canada regarding the proportion of gas that is used solely and unaided for its luminosity does not apply in this country, then we must give front place to Canada for superior efficacious methods in producing among consumers the scientific application of gas. The statistics collected by Messrs. Hewitt and Keillor present the fact that of 4995 million feet of gas sold, 57 per cent. is used for heat and fuel, 32 per cent. for incandescent lighting, and only 11 per cent. for flat-flame burners. In 29 years there has been an entire reversal of figures. The beginning of that period witnessed the nativity of incandescent gas lighting; and then no less than 90 per cent. of the gas sold was consumed in flat-flame burners. This complete change in circumstance has, singularly enough, little weight in some quarters; but we can only marvel, and pass on, impressed ourselves by the superfluity in this country of consideration for illuminating power.

The tests in the report from Canada confirm all that has been disclosed here, by extended study, as to the irregularity of illuminating power in relation to calorific value, and all that has been disclosed, too, as to the differences that exist in the calorific values of coal gas, water gas, and mixed gases. There is one table—the last one dealing with the subject—which shows how low it is possible to run the illuminating power of coal gas without seriously affecting the calorific value. The lowest figure in this table exhibits a candle power, with the Sugg 16-candle burner, of 11·76, with a gross calorific value of 575·28 B.Th.U. However, the reporters conclude that a gas of about 13-candle power, tested by the Sugg 16-candle burner, and containing about 540 B.Th.U. net is sufficiently high for all practical purposes. To us it seems that, in fixing on 540 B.Th.U. net, Messrs. Hewitt and Keillor have overstepped the line of practicability; the figures in the table showing that such a net calorific value would not give sufficient margin, if applied as a standard, with 13-candle gas tested by the No. 1 burner. Unless there is absolute surety, suggestions of figures for calorific standards are best left unmade. The one they mention is higher than the Gaslight and Coke Company's calorific standard, with 14-candle gas, and that calorific standard is higher than we should like to see generally applied. This is a matter that has on former occasions been discussed editorially.

A Diagram and Two Observations.

In last week's issue (p. 129) was published the diagram, showing the results of gas testings by the flat-flame, the No. 1 "London" argand, and the "Metropolitan" No. 2 burners, exhibited by Mr. Isaac Carr in Committee Room No. 6, for the purpose of illustrating his contentions, during the proceedings on the Standard Burner Bills. The diagram (not as exhibited, but as published by us) contained a dotted line which led from a result of 10·4 candles by the No. 1 burner to one of 15 candles by the "Metropolitan" No. 2 burner; and a footnote imparted the information that these figures were derived from observations made by Mr. Carr at the offices of the London County Council, 40, Craven Street, Strand, on the 7th inst. There is no suggestion in the footnote as to anyone else participating in the observations; and it indicates that Mr. Carr took upon himself full responsibility for them. It was necessary that he should do this, as there was no knowledge on our part as to the conditions under which the observations referred to were made. But the publication of these Craven Street figures was the subject of a mild protest before Sir Henry Kimber's Committee on Wednesday last, as it was considered that the conditions under which the observations were effected were not of the order that would constitute a reliable test. The observations were made on the occasion of the visit of Sir Henry Kimber and the other members of the Committee to the Craven Street testing-room; and it is quite clear the Chairman and his colleagues did not regard the readings as being of any comparative value, but merely looked upon what was done as a demonstration to enlighten them as to the use of the burners. But after all the diagram has had a value for the promoters of the Bills, as it intensifies the point as to the unreliability and uselessness of the No. 1 burner for giving a relative value to gases of different candle powers. The figures to which objection is taken as being unfair show an illuminating power of only 10·4 candles with the No. 1 burner and 15 with the No. 2. This is on Gaslight and Coke Company's gas. In the article on "The Quality of London Gas," published last week, the average results of the official testings of the Company's gas in the final quarter of last year, with the No. 2 burner and the flat-flame burner, are given; and it is seen that the average figure using the flat-flame burner (10·10 candles) was almost as high as Mr. Carr's Craven Street observation with the "London" No. 1 burner. In his own diagram, he shows a gas, giving only 5·51 candles with the flat-flame burner that returned 13·32 candles with "Metropolitan" No. 2. Instead of proving anything, the addition of the Craven Street figures only adds to the confusion that arises when one attempts to make any deductions from the diagram. However, those who were present at the time of Mr. Carr's observations at Craven Street are the best judges as to the suitability and fairness of the conditions; but the evidence itself suggests that they were not altogether regular.

The Competitors of the Coalite Company.

Whatever the Coalite Company are able to do in the matter of arresting the temperatures of carbonization at a particular stage, they have been, as our "Correspondence" columns have recently shown, unsuccessful in arresting the grant of a patent to the Scottish Smokeless Coal Syndicate, Limited. The Syndicate mean business; and, in our advertisement columns, they make an announcement which will no doubt lead to inquiries by gas undertakings as to working details of their system and proposals generally. In the advertisement, the Syndicate categorically state that their preparedness now to open negotiations for the adoption of their system and to do business, is due to "the British Coalite Company having failed in their proceedings against us." Their proposition is to grant licences, both at home and abroad, on reasonable terms, to corporations, gas companies, and others, for the manufacture, under their patents, of smokeless coal, gas, bye-products, &c. It is claimed that, by the Syndicate's methods, results superior to other processes can be obtained. There is sufficient in this statement to have a stimulating effect upon those anxious for information as to superiority in carbonization results. The Coalite Company manifestly do not like the Syndicate and their process; and they (the former) are renewing their strenuous efforts to get a number of gas undertakings to incorporate the coalite system in their working. Such correspondence as has been proceeding—spoken of as "negotiations" by the coalite people—with, so the claim runs,

over forty gas companies, is being made use of, as was seen last week, in the attempt to launch £300,000 of debentures to which is attached an alluring participation in profits. To the present it has not been noticed that investors have made any violent rush for the debentures. Perhaps the history of the Company and reminiscences of the advertised wonderful potentialities of the system in days that already appear afar off, have not hardened confidence in the concern.

More Municipal Gas-Works Results.

The chronicling of the results of the past financial year's operations of the municipally owned gas undertakings proceeds apace. Among the latest statements published, it is noticed that at Bradford the most striking and satisfactory feature of the balance-sheet is the fact that every item of expenditure on the manufacture and distribution of gas shows an improvement over the previous year. There was a small increase in the quantity of gas sold. The gross profit for the twelve months amounted to £58,405; being £4065 more than for the preceding year. After meeting interest and sinking fund charges, a trifling net loss is shown of £737, which result, however, is £4568 better than in 1908-9. At Bury, there is recorded a profit of £7152, one-half of which is handed over in relief of the rates, while the other half is utilized in directly benefiting the consumers of gas. Darlington exhibits a small falling off in the quantity of gas sold, and a decrease in net profit (£5033) of about £300. A sum of £4500 is transferred in aid of the general district rate, which is equivalent to a rate of 4·877d. in the pound. The percentage of gross profit upon the total capital employed is 6·399. The output of gas at Gainsborough was not quite so large as the year before; but the make per ton was higher, at 11,314 cubic feet. Considering the state of trade, the Committee regard the results as satisfactory. Ordinary consumers at Hereford are to enjoy a reduction of 3d. per 1000 cubic feet; and, at the request of the Finance Committee, it has been agreed to transfer to the borough fund the sum of £1000 from the balance standing at the credit of the gas revenue account. Sales of gas show an increase of 4½ million cubic feet (or 3·8 per cent.), while the quantity made was only 3½ million feet more than during the previous year—the leakage having been reduced from 6·8 to 5·9 per cent. The gas made per ton of coal was 11,315 cubic feet; the quantity sold per ton being 10,644 feet, compared with 10,224 feet the previous year. The disposable balance on the year's working is £1448. A small increase in sales was experienced at Kendal, where the price of gas to general consumers has been reduced from 2s. 8d. to 2s. 6d., and for public lighting from 2s. 7d. to 2s. 4d. per 1000 cubic feet. From a surplus of £1000, a sum of £800 has been voted in relief of the rates; the balance being carried to next year's net revenue account. Larger receipts and a reduction of price are reported from Mansfield. The Committee have decided to pay £1500 over to the general district rate now; and the question of any further payment will be considered later on. The average quantity of coal gas made per ton carbonized at Oldham was 11,666 cubic feet; the total amount of gas manufactured shows a decrease of just over 3 per cent. Private consumers took more; but the demand for mills and workshops decreased, owing to short time among the cotton-spinners and bad trade in machine-making works. The net profit on the year's working is £10,742. Under last year's Act, there is a limitation of the amount of profits which may be applied to the reduction of the borough rate to a fixed sum of £7500 per annum. The power to supply gas without charge for street lighting and other public purposes is, it may be remembered, limited by the same Act to public clocks and the infirmary.

A record make and sale, and decreased leakage, are reported from Rhyl, where the quantity of gas per ton of coal carbonized (11,508 cubic feet) and the sale per ton (10,425 feet) are also the highest figures in the history of the undertaking. A net profit of £1782 is available for the relief of the rates. At Salford, there has been the usual growth in the number of consumers; but the sales of gas show a very slight decrease—which is, no doubt correctly, attributed to the continued trade depression during the year. After meeting interest and redemption charges and allowing £6500 for depreciation, there is a balance of £15,034, which has been transferred to the district fund account. The past year has, on the whole, been a very satisfactory one at Stockport. An average of 12,016 cubic feet of gas has been obtained per ton of coal carbonized, as against 11,923 cubic feet before. Nearly 24 million cubic feet more gas was disposed of during the past year than in 1908-9—the larger proportion having been taken by prepayment meter consumers. Practically £20,000 is to go in relief of local rates—a policy which, as has happened on previous occasions, gave rise to some discussion in the Council; certain of the members expressing the opinion that the price of gas to ordinary consumers was being kept up to an undue extent. The accounts of the Stoke-upon-Trent Corporation show a balance of £684, of which £642 has been applied in relief of the district rate. The net profit is equal to 1·24d. per 1000 cubic feet of gas sold; whereas for the year 1908-9 there was a deficit equal to 1·77d. The make of gas per ton of coal was 12,304 cubic feet, of which 11,291 feet were sold. There is a net surplus at Tipton, after payment of interest and instalments on loans, of £1238, which shows the satisfactory increase of £966 when compared with the preceding year. This has been added to the accumulated profits account. The total quantity of gas made was 126,368,000 cubic feet, against 118,343,000 feet; the amount of coal gas per ton carbonized being 11,550 cubic feet, compared with 11,211 cubic feet. The Tyldesley-with-Shakerley gas undertaking shows a net profit of £591, which has been added to the reserve fund. A small increase in consumption is practically accounted for by the prepayment meter users—ordinary meter consumption exhibiting a trifling decrease. Depression in the cotton and other trades has, it is pointed out, exercised a detrimental influence on the operations of the department; and a reduction in price has also to be taken into account when considering the results.

A Cool Request.

We have from time to time had occasion to comment upon the attempts made by officials of local authorities to obtain professional advice and information on the cheap by means of the inquiry circular; and our remarks have, it may be hoped, led to the consignment of all such documents to the waste-paper baskets of those who have received them. Possibly the Clerk to the Urban District Council of Wem, in Shropshire, may have been aware of the fruitlessness of the efforts of others in the direction indicated; and so he recently decided to take another course. He availed himself of the "Queries" column of the "English Mechanic" for the 8th inst. to inquire if any reader of that publication could give him "an approximate estimate of the cost of establishing an up-to-date, but not necessarily elaborate, coal gas works, suitable for supplying gas for a small urban district of 2300 inhabitants, with 500 houses, 90 public lamps, about four miles of gas-mains, with an annual consumption of 10 million cubic feet of gas." The site of the proposed works is not to exceed £500. We do not for a moment suppose that there are many readers of the publication named who would be in a position to furnish the required estimate, or, if they could, would be willing to do so without a fee; and therefore it will have to be sought elsewhere. The particulars required correspond very well, allowing for subsequent growth, with the latest published statistics in regard to the town referred to; and this justifies the conclusion that the erection of gas-works by the Urban District Council is in contemplation. If so, they must bear in mind that a Gas Company has been in possession of the field for the last fifty years, and that Parliament would not be likely to sanction the raising of money for the establishment of a competing undertaking at the ratepayers' expense. If purchase of the existing works is in contemplation, and the District Council wish to get (through their Clerk) an idea of the price they ought to pay for them, their proper course would have been to instruct him to put himself in communication with one of the professional gentlemen who give special attention to these matters, and not to the editor of a weekly publication such as the one selected.

An Association of Consulting Engineers.

As the result of a movement initiated about two years ago, a meeting was held at the Caxton Hall, Westminster, last Wednesday, under the presidency of Sir William Preece, to ascertain the views of consulting engineers as to the advisability of forming an Association to improve the status of the profession, and to place it on a more satisfactory basis than hitherto. A Provisional Committee had been formed, upon which were Messrs. Charles Hunt and E. H. Stevenson, as representing gas engineers, and at their suggestion invitations to the meeting were sent out. The accept-

ances and the expressions of sympathy with the movement by those who could not attend were very encouraging; and, as will be seen from the report of the proceedings at the meeting which appears elsewhere, the new Association was duly formed, with a good representative Committee. It was pointed out that, at present, if a municipal authority erect works, even of large magnitude, they are not compelled to employ a qualified man to advise them; and there is nothing to prevent an absolutely unqualified one offering his services and being retained. It is considered to be an anomaly for this to be possible in matters where public safety and the expenditure of large sums of public money are involved; and it is hoped by those who have been instrumental in the formation of the new Association that the result will be to give the public the same safeguards in cases where they retain consulting engineers as they now have when the advice of a solicitor, a doctor, or an accountant is required.

The William Young Memorial Lecture Fund.

In the "JOURNAL" for the 24th of May last (p. 484), we gave the first list of subscriptions to the above-named fund, which, it may be remembered, is being formed to carry out a scheme of the North British Association of Gas Managers for founding a Lectureship to commemorate the great work of the late Mr. William Young in the gas and kindred industries. We have now received from the Hon. Secretary and Treasurer of the fund (Mr. Alexander Bell, of Peebles), the following second list, which brings up the total subscriptions to £422 19s. As the amount required is about £600, it will be seen that there is still a considerable deficiency; and as the Committee are very anxious to have the fund completed before the annual meeting of the Association on the 28th inst., Mr. Bell is making a second appeal to those who have not already subscribed; and we trust there may be a prompt response to it.

SECOND SUBSCRIPTION LIST.

Total of first list	£357	1	0
Aberdeen Town Council	10	10	0
Alex. Wilson, Glasgow	5	5	0
Bathgate Gas Company	5	5	0
Dalkeith Gas Company	5	5	0
Lasswade Gas Company	5	5	0
Joseph Hepworth, Edinburgh	5	0	0
Perth Town Council	5	0	0
Airdrie Town Council	3	3	0
W. B. M'Lusky, Perth	3	3	0
Kirriemuir Gas Company	2	2	0
Samuel Milne, Aberdeen	2	2	0
J. Napier Myers, Saltcoats	2	2	0
Vale of Leven Gas Company	2	2	0
Alex. Smith, Glasgow	2	2	0
Henry Balfour and Co., Leven	1	1	0
John Barker, Leven	1	1	0
Broughty Ferry Town Council	1	1	0
Markinch Gas Company	1	1	0
Polmont District Gas Company	1	1	0
James Whyte, Seaham Harbour	1	1	0
D. F. Wishart and Co., Edinburgh	1	1	0
R. W. Cowie, Dalkeith	0	5	0
Total	£422	19	0

City and Guilds of London Examinations.

In last week's issue there were given the names of the successful candidates in the recent "Gas Engineering" and "Gas Supply" examinations, with the exception of those who passed from one particular centre. It is now possible to complete the list by the mention of the following passes in "Gas Supply:"

Honours grade, first class	Ardron, F. C.
,, ,,	Dyson, Thomas
,, ,,	Schofield, T.
,, second class	Holroyd, J. W.
Ordinary grade, ,,	Aldred, James
,, ,,	Howard, William
,, ,,	Metton, Arthur
,, ,,	Peel, Robert

We are informed that Mr. Arthur Sumner, Assistant at the works of the Grays and Tilbury Gas Company, has now been entrusted with the entire charge.

In the "JOURNAL" last week (p. 107), reference was made to the appointment of a Chief Clerk to the Cheltenham Gas Company. The name of the successful applicant for the position should have been given as Mr. P. E. Culling.

The President of the Institution of Gas Engineers (Mr. Alexander Wilson, of Glasgow) has received from the President of the Société Technique du Gaz en France (M. Marquisan) a letter informing him that the Committee of the Society have elected him an honorary member.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 222.)

THE Stock Exchange was not wholly immune from foreign agitation last week, though the centre of disturbance this time was not transatlantic. This occasioned some anxiety regarding the settlement; but when this operation had been effected without much difficulty beyond one small failure, the situation was relieved. Taken all round, the higher class of investments bore up very well. The opening day was favoured by the sharp recovery in the American Market at a late hour on the previous Saturday. Gilt-edged securities were good, although Consols did not rise. Rails hesitated and then became stronger; and many speculative lines did well. On Tuesday, business was very quiet, as the settlement was on hand. Government issues were scarcely so good. Consols fell $\frac{1}{8}$; but in most other quarters the tone was pretty good. Wednesday was a fair day. Consols recovered, Rails were firm, and the Foreign Market bright; but Americans were inclined to see-saw. The good tone continued on Thursday; but business was at very low pressure. Gilt-edged stocks were strong. Consols rose $\frac{1}{8}$; and most other departments were fair. The lethargy of the markets continued on Friday; but they were still cheerful, though rails showed some disposition to realize. Saturday was much the same on a very small scale, and there was very little movement in any line. The Money Market was abundantly supplied, and short loans could be had on easy terms. Discount rates fell, too, but steadied a bit before the close. Business in the Gas Market was rather more active, and showed a nice, firm tendency; several of the more important issues effecting advances in their quotations. In Gaslight and Coke, the ordinary was conspicuous for activity and strength, steadily advancing in price from $104\frac{3}{4}$ marked on Monday to 106, at which figure several transactions were recorded before the close. The secured issues were very quiet; the maximum realizing $88\frac{3}{4}$, and the preference $104\frac{1}{4}$. In South Metropolitan there was firmness, but no activity. The quotation advanced $\frac{1}{2}$, with transactions at from $121\frac{1}{4}$ to $122\frac{1}{2}$. The debenture marked $79\frac{1}{2}$ *ex div.* Commercials were quiet but strong. The 4 per cent. changed hands at 110 (a rise of 1), the $3\frac{1}{2}$ per cent. at 105, and the debenture at 81. Among the Suburban and Provincial group, Bournemouth "B" was done at $16\frac{1}{4}$ and $16\frac{1}{2}$, Brentford old at 253, ditto new at $189\frac{1}{2}$, British at $44\frac{1}{4}$, Brighton original at 216, Hastings $3\frac{1}{2}$ per cent. at 95, South Suburban at 121 and 122, and Tottenham debenture at 99. On the local Exchanges, Newcastle was marked at 104, Sheffield "A" at 235, and Tynemouth at 114. In the Continental Companies, Imperial was steady at from 179 to 180, ditto debenture marked 94, Union 91 (a fall of $1\frac{1}{2}$), European fully-paid $24\frac{1}{4}$ *ex div.*, ditto part-paid $18\frac{5}{8}$ *cum div.* and 18 *ex div.*, and Tuscan $9\frac{1}{2}$. Among the undertakings of the remoter world, Bombay made 6, Hong Kong $17\frac{1}{2}$, Melbourne $4\frac{1}{2}$ per cent. 101 and $101\frac{1}{2}$, Oriental 140, Ottoman $6\frac{1}{2}$, Primitiva $7\frac{5}{16}$ and $7\frac{7}{16}$, ditto preference from $5\frac{5}{16}$ to $5\frac{7}{16}$, ditto debenture $97\frac{1}{2}$, River Plate 97, San Paulo from $15\frac{7}{8}$ to 16, ditto preference $11\frac{7}{8}$, and ditto debenture 50.

ELECTRICITY SUPPLY MEMORANDA.

Municipal Experiences—Reduced Lighting Consumption, Deficits, &c.—Week-end Collapses—Provisional Orders.

NOTICES of the annual accounts of a large number of municipal electricity undertakings have been published by our electrical contemporaries; and a considerable number more have not been. What the condition is of those that have not been published cannot be said; but, judging from those that have received notice, it is imagined that it is felt that too much publicity is not a desirable thing. As in years past, there are several of the fortunately located undertakings that have done fairly well—that is to say, well under the existing circumstances of the economy-producing metallic filament lamp and the greater consumption of power units at prices much below those charged for lighting. But there are numerous others that do not make a good showing, though there are all the signs (shutting our eyes to the all too general non-provision for reserve and depreciation) in the accounts of trimming here and trimming there in the endeavour to produce, however small, something to show as a net surplus. And poor, emaciated-looking net surpluses some of them are! Reduced consumption and smaller revenue from private lighting, owing to the active operation of the metallic filament, appear to be almost universal; and new business in this direction at the full lighting rate comes in with disheartening sluggishness. What with the loss in business in full-priced units and the gain in business in low-priced units, had it not been for a decrease in working expenses (reduced coal costs largely accounting for this), many accounts would have made a much worse showing. The point as to the effect of reduced coal costs is clearly shown by Nottingham, where £1800 less was paid for coal during the year than in the preceding one. But it is conceded that the complete effect of the change from carbon to metallic filament lamps has not yet been felt; and upon this the undertakings will during this year have to face somewhat heavier charges for coal—the same as

gas undertakings. Apart from coal costs, there is not much room for more economical and efficient working at generating stations fitted with modern plant. Therefore central station engineers who have been making estimates for the current year will have done well if they have not pitched their hopes too high.

Just a few figures, by way of illustration, as to the effect upon the consumption of the heavy price lighting units owing to conversion from carbon to metallic filament lamps. At Brighton, the year saw a decline by 148,926 in the number of units used in private lighting; but there was a good increase for tram and power purposes. From Croydon comes the report that the metallic filament lamp has continued to exercise a marked effect on the output. But although the net increase in consumers in the past two years has been 617, the electricity sold for lighting has only added to the total 18,000 units. We go to Eastbourne, and find the units sold there for private lighting have decreased by 2·6 per cent. Private lighting consumption at Huddersfield dropped down by 126,544 units; while the power business increased by 77,995 units. Leeds made the retrograde movement in the private lighting consumption of 665,566 units; in street lighting, of 51,592 units; while power and heating (at much lower prices) just topped the decline in lighting units with an increase of 743,204 units. Nottingham, too, had a set-back in the number of units sold for private lighting, but an excellent augmentation of the power units. From Rochdale there is the report that the increase in the units sold was practically all due to electricity for power purposes. An interesting and significant feature is exposed by the figures as to the consumption at Canterbury. There the private lighting sale amounted to some 309,800 units. The public lamps (12 arcs and 655 incandescents) absorbed 206,143 units, or the equivalent of two-thirds of the private consumption; and only 172,907 units were sold for power. This is instructive as to how public lighting is made in Canterbury and some other places to swell the volume of units generated, and incidentally the capital expenditure on plant (involving interest and sinking fund) to meet the maximum load.

In presenting a few illustrative figures as to deficits and small net surpluses, we do not suggest the lists are in any way complete; and the confession is repeated that notice is not taken of the undertakings that show a greater financial success. Their successes are due to local conditions just as is the want of success in other cases, though the latter result of much of the municipal management is due also to the want of courage in not making consumers pay on a scale that will yield sufficient revenue for all purposes. Electricity, we understand from electrical literature, has so many virtues that nothing so vulgar as expense should stand in the way of its adoption; so that there is no excuse, on the electricians' own showing, for deficits. Examples of deficits are: Bath, £580; Buxton, £485; Dover, £227; Hastings, £2919; Hove, in respect of Aldrington undertaking, £404. Loughborough required for interest, sinking fund, &c., £2311; and there was only a balance of £854 with which to meet it. Deficits were also incurred by Maidstone, £101; Peterborough, £1801 (here a recent arbitration case, however, cost £1016); Sheffield, £2035; Stalybridge, £469; Sunderland, £112; Weymouth, £113; Worcester, £1401; and York, £985. Barnstaple only had a net balance on revenue account of £560. Representative of the net balances of municipal undertakings in various parts of the country are the following: Barrow-in-Furness, £249 (against a net deficit in the previous year of £384); Bexhill, £624; Burton-on-Trent, £1474; Canterbury, £562; Colchester, £414; Epsom, £185; Gloucester, £584; Huddersfield, £710; Ipswich, £1080; Lancaster, £84; Leigh (Lancs.), £112; St. Helens, £1031. At Leicester since 1907, the total revenue has fallen from £33,882 to £28,832—a difference of somewhere about £5000. The net profit has dropped meanwhile by £2600.

There are two or three of the towns mentioned in the previous paragraph to which further reference may be made. The deficit in the case of Sheffield, it will have been noticed, is £2035. But this sum does not disclose the full effect of the metallic filament lamp. As a matter of fact, the lighting current shows a decline from £53,117 to £46,264, or £6853, representing a drop of 312,150 from the number of units sold for private lighting. The year before, the falling off in private lighting income was £4251; and it is anticipated that the decline will continue for some time to come. There were 299 new private connections made in the year, against 217 the year before. There is a point regarding the consumption that should make administrators of electricity undertakings pause. It is seen that the diminution in the sale of private lighting units was 312,150; but, as a matter of fact, there was (including all branches of business) a total increase of 1,288,192 units sold over the preceding year. Notwithstanding this big bulk of additional power business, which swamped by volume more than four times over the loss in the private lighting business, there was the deficit on the year of upwards of £2000. To us there seems something wrong in the administrative policy when an increase of business in one direction that is fourfold the loss in another direction does not produce more than a full measure of compensation for the latter. Then there is the Hastings deficiency of nearly £3000, although there was an increase in the receipts from public lighting from £3088 to £3750. This undertaking is having the unhappy experience of seeing the total volume of units sold shrinking year by year, despite the action of the Corporation to transfer to the concern all business over which it has any disposing power. In 1908, the number of units sold was 821,671, it slid down the following year to 755,372, and last year to 731,914. But in the same three years the number of consumers mounted up from 899 to 1001, and last year to 1067. Regarding these increases in conjunction with the consumption decreases, they indicate that the consumers who are now being tapped are a less remunerative class than the older ones, and are not by any means of sufficient strength to counterbalance the ravages of the metallic filament lamp. It will also be observed that there is a slackening of the new connections. In 1908-9 there were 102 new ones; in 1909-10, only 66. The poor deluded ratepayers have two other figures over which to meditate and mourn. Since 1898, the net profits have totalled to the paltry sum of £1473; in the same period, the deficits have reached the significant amount of £14,000, to say nothing as to the heavy charges for public lighting, and costs of street-lamp conversions, which unnecessarily the ratepayers have been made to bear—and not in the interests of local government with economy and efficiency. A word, too, as to Maidstone. While the deficit is only £101, the position compared with the previous year is worse by £1173; seeing that there was a net profit the year before of £1073. In addition to the £1173, there have been amounts set against profit appropriation account which bring the financial difference up to £2121. The items include sums which might otherwise have gone to capital, amounting to £258; the cost of converting public lamps from Nernsts to Osrams, £102; and the amounts written off wiring and arc lamp accounts, £459 and £117 respectively. It is not astonishing that there is dissatisfaction in many places over the financial position of the electricity undertakings. But as in the beginning, so now, and we suppose ever will be, prophecy is frequent that the good time is coming when the crooked paths of electrical finance will be made straight, and all will then be well.

It is a curious thing to us why so frequently the electric light goes on strike on Saturday evening. We have often wondered, and have carefully examined the matter, but a satisfactory solution of the problem has never yet resulted. Perhaps it is that the generating machinery is of opinion that it ought to share with humanity generally and the mechanical plant of other industries the week-end rest. Gas-works plant in many places, if it does not get the whole week-end, is enabled, through the gasholder storage, to have off the daylight hours of Sunday. Looking back over only the last two or three numbers of the "JOURNAL," it is seen that Wrexham, Pontypool, and Woking have suffered collapses on Saturday nights; and great has been the inconvenience caused thereby. It is the great shopping evening of the week; the evening, too, above all others when the theatres, music halls, cinematograph shows, and other places of entertainment are being heavily patronized. To buyers and recreation seekers, the inconvenience is considerable; but not so great as to tradesmen and managements of the theatres and so forth, who are harassed on one side and the other, and are losing money and profit the whole time the light is out. Brighton suffered a collapse last Sunday evening week; the extinction synchronizing with evensong at the churches, and dinner time at the hotels; but fortunately a little bit too early to seriously affect the public and the other private lighting. The occurrence was, however, general. There has been an attempt to minimize it by describing it as temporary. But during a twenty minutes' collapse, much may happen, much worry may be occasioned, and many wicked things may be said. The time is quite long enough to seriously disturb the local tide of human affairs and happiness. And yet all the technical skill and foresight of the electricians cannot prevent these untoward occurrences! Still there is this to be said in extenuation. It is not an uncommon thing to find some people more unreliable at the week-end than at other times; and so we must not treat too harshly the week-end backslidings of electrical plant. We can, in fact, afford to be generous in the matter; for such vagaries are good for the gas industry.

The number of applications to the Board of Trade for Electric Supply Provisional Orders and the number granted continue to dwindle. Altogether last year there were 25 applications—14 being made by local authorities, and 11 by companies or persons. But seven of the applications were merely for extension or amendment of existing Orders, and one was a Transfer Order. Nineteen Orders were granted in part or in whole; but six were refused or the promoters determined not to proceed from one cause or another. In three cases—Ballyclare, Brumby and Frodingham, and Templemore—the Board were not satisfied that undertakings could be established without involving the District Councils in a loss; and in these instances they declined to grant Orders. Under the circumstances disclosed by a local inquiry, too, the Board did not approve of the granting of the Radcliffe Order proposed by the Lancashire Electric Power Company. It is satisfactory to find the Board exercising a judicial discrimination in the matter of granting powers to the governing authorities of small places, and protecting ratepayers against the speculative propensities of these bodies. No less than a couple of dozen deeds of transfer of powers to companies—eleven to the Lancashire Power Company—have been approved during the year. It is to be regretted that there was not greater discrimination in granting Orders, and many more transfers from local authorities to companies, in days past; not a few ratepayers would have been better off than they are to-day. Including the figures for 1909, 1361 Orders have been applied for since 1883, 1086 have been made by the Board of Trade, 1069 have been confirmed by Parliament, and of these 309 have since been revoked or repealed, or else have expired.

NOTES FROM WESTMINSTER.

Complete Success of all the Standard Burner Bills.

LAST Friday will stand as a red-letter day in the annals of the gas industry; for on that day Sir Henry Kimber's Committee gave judgment on the cases (to which they had devoted such patient attention for a fortnight) for and against the Standard Burner Bills; and the judgment, as did that of the House of Lords Committee, completely vindicates the action of the promoters, certifies the strength of their case and concurrently the weakness and inconclusiveness of that of the opposition, and maintains unaffected the position that Parliament and the Board of Trade have consistently taken up in regard to this particular question since the sittings of Lord Rayleigh's Committee. Had Sir Henry's Committee decided to the contrary, a grave injury would have been done to the progress and development of the gas industry along its natural highway.

The Week's Proceedings. Tracing the course of the proceedings before the Committee during the week, it will be remembered that the hearing of the case on No. 1 Bill concluded the previous Friday. The Liverpool Company were included in the Bill; and, by an instruction of the House, as it was considered there were special justifying circumstances, Liverpool was set apart for a special hearing. On the Friday Mr. Honoratus Lloyd opened the case for the Company; and Mr. Charles Carpenter (who has led the evidence throughout, and with unremitting zeal has worked hard, as would his late chief have done in the circumstances, to gain for the gas industry the victory in this critical struggle) and Mr. Edward Allen gave testimony. The proceedings were resumed on Tuesday, and the case was threshed by the parties unceasingly during the sittings of the Committee on that day and Wednesday. Mr. Honoratus Lloyd replied on Thursday morning; and on Friday the Committee took up special points in connection with the opposition to Bills Nos. 2 and 3. Concerning No. 2 Bill, although twenty companies were included (representing twenty-two gas undertakings in all), there were only six authorities opposing; and respecting No. 3 Bill, though there were fifteen promoting companies, there were only five opposing authorities. But there was nothing whatever that was really special in the matters they had to place before the Committee; and they were dealt with very lightly. And really, after a fortnight in refighting fights that have for years now consistently ended in victories for the new standard burner, and refighting them by introducing, as did the opposition, much petty detail and extraneous matter, and bringing witnesses forward again and again to march over the same ground, most of those present were unfeignedly glad when the end was in sight. We will not discriminate as to when the witnesses were called, but evidence was heard during the week for the promoters from Mr. Charles Carpenter, Mr. Edward Allen, Captain Sankey, Mr. Samuel Glover, Professor Vivian B. Lewes, Mr. William Ashmole (the Chairman of the Ilford Gas Company), Mr. William Cash, and Mr. E. Campbell Cooper (Messrs. R. W. Cooper and Sons, the Agents for the Bill). Again too, were heard on the hostile side the inseparables, who have been the constant technical witnesses for the opponents throughout this struggle of the gas industry for the new standard burner—Professor Frankland, Mr. Isaac Carr, and Mr. J. G. Newbigging, and joined to them for Liverpool was Dr. Arthur A. Musson, Assistant Medical Officer of Health. For the Mersey Docks and Harbour Board, who were specially represented by Mr. Balfour Browne, K.C., evidence was given by Mr. A. G. Lyster (the Engineer), Professor Burstall, and Mr. R. D. Holt, M.P.

Points Raised. In the special case of the Liverpool Gas Company, the Liverpool Corporation, the Bootle Corporation, a number of District Councils, and the Mersey Docks and Harbour Board were arrayed in opposition. The long career of the supply of a high-grade illuminating power gas in Liverpool was the secret of all the opposition in this instance. The opponents seemed to have, or professed that they had, a distinct preference for a high illuminating power gas *per se* than for taking advantage of the higher efficiencies now to be obtained by a lower grade gas used in modern appliances. Not only is Liverpool among English cities and towns exceptional in the height of the illuminating power of its gas, but the burner applied to the testing of that gas is the flat-flame one. If in any place a change of burner is needed, that place is surely Liverpool. When witnesses point, as a reason against a change of test-burner to the number of flat-flame burners in use by consumers in Liverpool, it only shows how the high illuminating power gas has been an obstruction to the application of scientific invention in dealing with the gas. It is a peculiar position in which the opponents found themselves. Fifteen years ago the Lighting Committee of the Corporation were urging the Gas Company, in view of scientific progress, to consider the reduction of the standard illuminating power of the gas supply and the further cheapening of the price by that means. But a fine old-crusted conservatism then prevailed in the Company's counsels, which declined to recognize that anything that had not been customary could be the correct thing in the future. The Mersey Docks and Harbour Board had also been threatening the Company that, if they did not further reduce their price, they would transfer their patronage to some private producer gas (very low grade gas) plant. In face of these actions, here were the Corporation and the Docks and Harbour Board hostile to the change of test-burner, and predicting all manner of evils if the illuminating power of the gas were interfered with, be it never so slightly. Truly, 'tis a strange world, and there are strange people in it. Dr. Frankland when recalled still persisted in asserting that high illuminating power gas was the best in securing the utmost round of efficiency for the several purposes to which gas is applied in modern times. He is the odd man among scientists on this question. Mr. Carr is against him as to high candle power gas being best; Mr. Newbigging's practice at Manchester is against him; and Professor Burstall—all named being witnesses on Professor Frankland's own side—prefers low illuminating power gas for gas-engines.

Emphasizing the hypotheses and the inconsistencies of the opposition case, some wonderful calculations (with a laboratory and not a practical basis) were put in as to the financial and other effects that would betide the poor benighted flat-flame consumer (who foolishly refuses the economy of the incandescent light) if Parliament grants the No. 2 burner to Liverpool. The opponents did not like any talk about the inaccuracy of the existing test-burners and the accuracy of the new one. Mr. Balfour Browne found the point to be a thorn in his side. But it was impossible to escape from the fact that the flat-flame test-burner does really depreciate the candle power capacity of a gas; and through the inefficiency of the burner, the consumer gets more than that to which he is entitled, and more than he requires, if he will but shake off antiquity and apply that which is modern. The opposition actually asked for the nominal candle power to be raised if the change of burner was introduced. If such a thing as that had been done, then the users of incandescent burners, of heating and cooking stoves, and of gas-engines would have had just cause for alarm and complaint for being given a gas that is not so efficient for their purposes through the difficulty of thoroughly aërating the heavy hydrocarbons of a rich illuminating power gas, and through the choking occasioned in consequence by incomplete combustion. Captain Sankey (for the promoters) and Professor Burstall (for the opposition) showed that a lower grade gas would not affect the working efficiency of gas-engines, and some large-scale practical experience under this same head came from Mr. Carpenter in regard to South London. Professor Lewes put the whole matter in a nutshell when he said that, if the change of test-burner were not widely advertised, there would not be a single consumer who would be aware of it. Moreover, in Liverpool the Gas Company are kept under very strict surveillance both in regard to quality and finance; and being a maximum price concern, with a full reserve, all savings must go to the consumers. The general result is that nobody will be injured by the change of burner.

A Complete Victory. The decision of the Committee was delivered by Sir Henry Kimber in terms and with reasoning that disclosed how thoroughly the Committee had mastered all the principles and interests that lay at the foundation of the confused mass of submissions and contradictions that had been accumulated during the fortnight. Sir Henry announced that the preambles of the Bills had been passed. This was expected on both sides. But there was anxiety to hear if the Committee had decided to impose any conditions, for those were the things that would matter. There was intense pleasure when it was heard that the new burner was to be allowed unconditionally to all—thus confirming the verdict of the House of Lords. Sir Henry went on, calmly and mercilessly, to demolish the whole of the crude structure of the opposition case in a very few weighty sentences. The Committee recognized, he said, that the test burners hitherto in use have been defective, and that the burner proposed to be established as a standard one is, if not perfect, yet as perfect as is at present known for achieving the object Parliament had certainly intended. As to the compensation of consumers for the change of test-burner, the Committee, he remarked, were "unanimously" unable to see that, or to recognize the fact that the use of an imperfect burner in the past gave any right to compensation further than the legislation applicable to gas companies will automatically give. It was agreed by the Committee that the hardest case of all was that of the Mersey Docks and Harbour Board; but they believed also in this case that the Board would be practically compensated by the reduction which might be expected in the future from a Company who had conducted their affairs honestly and with fairness. The officers of municipal bodies who had appeared in opposition to the company promoters of these Bills heard the Committee's view that legislation affecting gas companies had been more strict than legislation affecting local authorities. The Committee would not entertain any suggestion as to the imposition of a calorific power clause, considering it to be outside their purview. The Chairman also expressed the opinion that these Bills formed a step in the revision of general legislation referring to gas. The decision is indeed a complete victory.

Opposition's Total Gain. The total gain of the opposition, out of the bundle of clauses they placed before the Committee yesterday morning, was that the Bootle Corporation obtained the right to a testing-place at the Linacre Gas-Works of the Liverpool Gas Company. As there is a testing-place at the works already, the Company did not make any serious demur to the proposition; and they acceded to Bootle having the privilege desired. Whether, after the novelty has worn off, the Council will make any considerable use of their

privilege, is another matter. At the close of the discussion, the Chairman acknowledged the patient assistance he and his colleagues had received from Counsel; and, with the exchange of courtesies, the proceedings closed. The result has inflicted the most crushing blow on obstructionist local bodies that has been witnessed in Parliament in connection with gas for many a day.

South Hants Water. The Southampton Corporation always are looking with eyes of envy on their neighbours the South Hants Water Company, part of whose district—and the most lucrative part—is now within the borough boundary through the extension of the latter. The Corporation have appeared in opposition to the Company's Bill, primarily with the view of placing themselves in a better position for swallowing the Company's concern if Parliament sanctions that course. The Bill is intended to confirm certain works already carried out by the Company, and to sanction a new well at Twyford. The Bill has passed a Committee of the Lower House; and last Friday week Mr. Balfour Browne, K.C., introduced the measure to the notice of the Duke of Bedford's Committee. He did not get far before the Committee adjourned; and he resumed his speech on Monday morning. The Southampton Corporation are jealous of their Otterbourne Water-Works; and they seem to fancy the Company's operations at Twyford will affect the works. They therefore asked, through the Hon. J. D. Fitzgerald, K.C., for the limitation of the quantity of water pumped to one million gallons a day. This Mr. Balfour Browne strongly resented, but offered a limitation to 2½ million gallons. The Committee were more in sympathy with the little Company than with the big Corporation; and they declined to descend below the 2½ million suggested by the former. Then the Corporation sought a suspensory clause for a year, in order to give them time to promote a Purchase Bill. This again the Committee refused. In fact, they appeared to be disinclined to do anything that would be detrimental to the weaker authority, and confer favour on the stronger Corporation. Thus the Water Company obtained practically all they desired. Mr. William Matthews, who was at one time Corporation Water Engineer for Southampton, appeared in support of the Water Company, to whom he is Consulting Engineer. Among other witnesses for the Company was Mr. Eaton; the Corporation did not call evidence.

Protecting a County. The Breconshire County Council have always an eye to the main chance. The Mountain Ash District Council are proposing by a Bill in Parliament to construct new water-works at Penderyn—a short distance beyond the Glamorganshire boundary in Breconshire. When the Bill was before Earl Donoughmore's Committee, there was no opposition to the preamble, which was passed; but Mr. Talbot, K.C., asked for protection for Breconshire interests. Similar protection has been granted in the case of the water-works of Birmingham, Cardiff, Swansea, Merthyr, Aberdare, Neath, and Pontypridd. In one respect, Breconshire is fortunate. It is rich in water, and has the gratification of knowing it can fill the wants in this respect of many large communities. But it is poor in rateable value, being purely agricultural land. When, however, these large water-works are constructed, as Mr. Wedderburn, K.C., points out, ample compensation for any temporary expense the county is put to during the construction of the works is obtained from the permanent addition to the county's rateable value. But it is the temporary expense against which the county desired to be guarded by special clause. The expense, it is said, is occasioned by the dislocation of local arrangements incidental to the introduction of large bodies of workmen. Additional police have to be provided, the education of the children of the workmen has to receive attention, hospital accommodation is needed, and so forth. The Committee disagreed with the insertion of any clause such as that proposed.

An Agreement. When the Pontypridd and Rhondda Joint Water Board Bill came before the same Committee as the measure named in the preceding paragraph. there was only the Rural District Council of Llantrisant and Llantwit Fardre opposing; and there was a prospect of agreement by a little patience. This was fulfilled; for on Monday, Mr. Freeman, K.C., was able to announce that an agreement had been arrived at, to the effect that until the new works are completed, the Joint Board shall give Llantrisant such supply of water as they have now, and so much more as the Board are able to spare. Further, as soon as the new works are completed, the Board shall give Llantrisant not less than 50 million gallons per annum and so much more as they require, subject to certain restrictions, to reasonable notice being given by Llantrisant of the quantity needed, and to a uniform price of 7d. per 1000 gallons.

Japan-British Exhibition Awards.—The distribution of the first instalment of awards adjudicated by the Superior Jury of the Japan-British Exhibition took place last Friday in the Congress Hall at the Exhibition. His Royal Highness Prince Arthur of Connaught presided, and the awards were distributed to the British exhibitors by Baron Oura, the President of the Imperial Japanese Commission, and to the Japanese exhibitors by the Duke of Norfolk. Among the recipients of Grand Prizes were the Gaslight and Coke Company, for their exhibit of the residual products of gas manufacture; Messrs. Babcock and Wilcox, Limited, for coal-conveying plant; Messrs. C. A. Parsons and Co., for steam-turbines; and Messrs. Read Holliday and Sons, Limited, of Huddersfield, for coal-tar products.

STANDARDIZATION OF STOVE PARTS BY GAS UNDERTAKINGS.

During the last year or two, there has been a tendency on the part of several gas authorities to adopt the policy of having a standard pattern of cooker peculiar to themselves, and inviting various manufacturers to quote for the supply of the apparatus, instead of for their individual products. In some cases, the arrangement is that the contractor is furnished by the gas authority with the necessary patterns; in others, he finds these himself, making them to the specification of the gas undertaking.

There are various aspects of this matter that are worth consideration. In the first place, the experience of any one gas department or gas manager, as regards the requirements in a cooker, is only the experience of one particular district; whereas a gas-stove making firm has an experience gleaned from all over the country, and is able to form an opinion of the good or bad results of any particular point in stove construction from the results of trial, not in one district only, but in many. At first sight, there doubtless appears to be a good deal to be said for this policy, from the point of view of the gas authority's interest. Theoretically, it assures them that all competitors for their contract are quoting exactly on the same footing, and for on the face the same article; and where the patterns are furnished by the gas authority, they are also in theory assured of getting stoves interchangeable, part for part with each other, and with those supplied by past and future contractors.

Whatever these advantages may appear in theory, the matter has an altogether different complexion when viewed in the light of certain practical considerations, which, in the nature of things, are liable not to be known, or, at the best, their importance not realized by the gas authority. Yet another point that it is most essential should not be lost sight of is that no two ironfounders carry on their work in the same way. Every foundry has its own methods, its own cambers, &c., its own iron mixtures, and therefore its own shrinkages; and investigation and test will amply show these points to have so immense a bearing on the results that, as a matter of fact, it is, for all practical purposes, impossible to get not merely absolute interchangeability, but even a satisfactory working degree of interchangeability between castings that are made from the same patterns in different foundries. The result of this is that frequent troubles necessarily arise when repairs and replacements are required.

It is also important to remember that as these contracts are for a limited period, and therefore really for a limited quantity, it is not possible for the contractor to go to the expense of the multifarious pattern-plates, jigs, and other tools necessary for producing so large a range of different parts with absolute interchangeability. The contractor who knows he may at the end of its period lose the contract, cannot spend the thousands of pounds necessary to lay down the proper special plant required.

So long as a system of this sort was confined to a few places, manufacturers might do their best to meet the conditions, even at a sacrifice. But if such a policy were to become anything like general over the country, it would mean that manufacturers must either use imperfectly adapted tools and plant, and therefore get defective interchangeability, as already mentioned, or else they must have a number of distinct sets of tools, each applicable to one section of their output only, instead of one series of perfect tools turning out their entire output in one type or design of apparatus, on which they are free to concentrate their energies in perfecting it from time to time by the help of experience gained all over the country. Obviously, this means greatly increased expense of production that is bound to re-act, sooner or later, on the price of the apparatus.

It is an unfortunate tendency that John Bull must have something made to suit his own individual tastes and requirements; whereas, in America and elsewhere, people accept apparatus which is adapted for the average uses of the community. In this way, all the advantage of the resulting cheapness of production from the large output of one kind of article, is preserved.

No matter what precaution may be exercised by the gas authority, it is impossible to tell from appearances, and even from a short trial, whether the real value of material contracted for has been put into various parts of the apparatus. It may be only after continued use that latent shortcomings in this direction may reveal themselves; and by this time the contractor responsible may have been superseded by another. Of course, contracts may be carefully worded so as to make the contractor liable in perpetuity; but experience shows that precautions of the kind are necessarily illusory.

Reference has already been made to the indirect but certain ultimate effect of this movement on the cost of production, and therefore on price. One need hold no brief whatever for the manufacturers, to recognize that what adversely affects their conduct of their own businesses, must, in the long run, re-act unfavourably on the wider interests of the industry. If the manufacturer is to find himself making special stove patterns for each gas authority, it means seriously interfering with the methodical and consistent working of his factory. For example, a great advantage in the production of any article, and particularly in its production on interchangeable lines, is that certain men should

be kept making that particular article until they have become thoroughly trained to it; but if men are taken time after time from one set of patterns to another, from these to a third, and so on, it is necessary to altogether forego this advantage.

The whole present tendency among men of the greatest foresight in the gas industry is toward the movement for perfecting and developing all gas apparatus on scientific lines. The establishment of the Leeds Chair and the work of the Institution Research Committee supply prominent evidence in this connection. It must be obvious, however, that, if this system of stardardized cookers were to extend, work of this kind on the part of individual makers would simply be "frozen out." Not merely the incentive to individual initiative and invention, but the possibility of it would be at an end if manufacturers had to direct their energies to the mere turning out of apparatus according to certain stereotyped designs over which they had no control, and in which, as contractors with no continuity of tenure, they could not have any interest. This consideration alone ought to be sufficient to set one seriously reflecting as to whether this tendency to standardization is not unconsciously a distinct reaction against the newer scientific methods. The moment stereotyping is carried to extremes, there is discouragement of development and invention.

PERSONAL.

Mr. George Ingham, Assistant-Chemist to the Sheffield Gas Company, has been appointed Works Assistant at the Ash Road station of the Aldershot Gas, Water, and District Lighting Company, in place of Mr. J. Urquhart, who has been promoted to the position of General Assistant.

During the last six months no fewer than four officers of the Metropolitan Water Board have been offered lucrative appointments under other public authorities. The latest addition to the ranks is Mr. W. P. Sinclair, who has been invited to accept the post of General Manager and Secretary to the Colne Valley Water-Works Company. Mr. Sinclair has been in the service of the Board since its constitution.

An interesting event took place at the works of the Hornsey Gas Company last Thursday, when Mr. J. W. Buckley, the Engineer and General Manager, presented, on behalf of the staff, a marble timepiece to Mr. Kenneth Sproxton, on the occasion of his marriage with Marion, only daughter of the late Mr. Edward Butler Hurley, formerly Superintendent of Postal Telegraphs, Ceylon. Mr. Sproxton is a son of the late Mr. John Sproxton, who was connected for so many years with the Hong Kong and China Gas Company and with the Colombo Gas and Water Company.

OBITUARY.

ALEXANDER BELL.

We regret to record the death last Tuesday, at Peebles, in his 74th year, of Mr. Alexander Bell, late Manager of the Dalkeith Gas Company. Mr. Bell was a native of Lasswade, and in early life served his apprenticeship with Mr. James Thorburn, Dalkeith, as a plumber. He came in contact with the late Mr. John Young, who was then Manager of the Dalkeith Gas-Works, and from him gained a taste for chemical and scientific research, which he kept through life. Afterwards Mr. Bell was appointed to the charge of the Lasswade Gas-Works; and after five years' experience, he left in 1863 to take charge of those at Gibraltar. After several years' service abroad, he returned home to take up the position of Manager of the Clippens Oil-Works at Loanhead, where, in conjunction with the late Mr. William Young, he found scope for his energies. He did much to develop the Scottish mineral oil industry, and assisted Mr. Young in working out many of the ideas embodied in his patents for the erection of benches of retorts for the distillation of mineral shale at high temperatures and the recovery of bye-products. On the collapse of the Clippens works, Mr. Bell returned to Dalkeith, and took charge of the gas-works. Under his management, they were entirely reconstructed, with new retort furnaces on the semi-regenerative principle and other incidental works. His reputation as a gas manager spread far and wide; and his knowledge of gas manufacture was largely appealed to by fellow-managers when they were in any difficult position. To these appeals Mr. Bell willingly responded, and both the Waverley and North British Associations of Gas Managers paid him the compliment of electing him to the office of President. He filled the latter office in 1897. Little more than a year ago, acting on medical advice, he resigned his appointment at Dalkeith, and retired to Peebles. Mr. Bell leaves a widow and family. His eldest son, Mr. Alexander Bell, is Gas Engineer and Manager to the Peebles Corporation, and another son—Mr. Laurence Bell—was a few years ago Manager at Inverkeithing, and was President of the Waverley Association in 1902.

With widespread sorrow, the news was received in the town last Friday that Mr. Stanley Hutchinson, the youngest son of Mr. W. W. Hutchinson, the Manager of the Barnsley Gas-Works, had been found in the test-room with his brains blown out. The deceased, who was 28 years of age and unmarried, had not been in the best of health for a few weeks; and it is understood that he was threatened with a nervous breakdown. He was under medical care, and had been recommended a complete change, with a view to regaining his health. He had been for a period in the Isle of Man, but did not seem better, though his condition was not by any means so bad as to give rise to any fear. On Friday afternoon, when going into the test-room a clerk was horrified to find young Hutchinson prostrate on the floor. In the right hand was a revolver, splashed with blood, containing one spent cartridge. The bullet had entered at the right side of the skull. Further search is stated to have revealed the fact that the deceased had a razor in his pocket; and a note was subsequently found. The inquest was held the following day, when it was stated that deceased had for about three years occupied the position of Chief Clerk in the gas office. The Coroner read a letter, written in pencil, which had been found on the body. It was not addressed, and was as follows: "It is the books. There is no money missing. It does not matter how hard one works, those books will want some balancing and transferring. There is no money in it at all; simply things are too busy, and not the time." The Jury returned a verdict of "Suicide while of unsound mind, caused by worrying about his work."

BELFAST GAS MANAGERSHIP.

A meeting in committee of the Belfast Borough Council was held last Thursday; and the local "News Letter" understands that the members first of all had before them the list of candidates for the position of Gas Manager and Engineer, together with the recommendations of the Gas Committee, who after going into the applications, which numbered in all 38, and making a selection, had instituted, by means of a deputation and otherwise, careful inquiries as to the capacity and qualifications of the candidates on the short list. Some discussion took place on Thursday regarding the merits of the respective applicants, and ultimately a vote was taken by ballot, which resulted in Mr. James Dunlop Smith, Engineer and Manager to the Stirling Gaslight Company, securing the post, subject to confirmation by the Corporation at the next monthly meeting. It is added that Mr. Smith is a native of Hawick, where he was born in 1872; and after leaving school, he served his apprenticeship as a mechanical engineer with Messrs. James Melrose and Sons, passing through the various departments and completing his indentures in their drawing office. For several years he studied chemistry under the local Public Analyst, and was very successful in Government examinations. In 1891, he was appointed Assistant Engineer and Manager to the Hawick Gaslight Company, under his father, Mr. Joseph Smith, who has since retired; and in 1893 he became Gas Engineer and Manager at Selkirk, where he remained for four years, carrying out in that time extensions and improvements in the Company's works which proved very profitable. In 1897, he was selected for the position of Engineer and Manager of the Stirling Gaslight Company, and had at once to set about the task of reconstructing and extending the works, which were in a dilapidated state. During the thirteen years he has been at Stirling, he has supervised the complete rebuilding of the works and the making of the several large extensions involving an expenditure of about £40,000, and introducing the most modern machinery. He had considerable experience in preparing plans and supplying information in connection with the promotion of the Stirling Gas Act, 1898, and Provisional Order, 1904. When he went to Stirling, the annual consumption of gas was about 60 million cubic feet, and the price was 3s. 6d. per 1000 feet; whereas the consumption has now been increased to 140 millions, and the price reduced to 2s. and 2s. 6d. per 1000 cubic feet.

[From Our Scotch Correspondent.]

Mr. J. D. Smith, the Engineer to the Stirling Gas Company, has been appointed, out of a list of 38 applicants, Manager of the gas undertaking of the Belfast Corporation. Mr. Smith is 38 years of age. He is a son of Mr. Joseph Smith, the retired Gas Manager of Hawick, and brother of Mr. W. A. Smith, the present Manager there. A Stirling newspaper, referring to Mr. Smith's appointment, publishes the statement that "the office is regarded as one of the plums of the profession, and the commencing salary is, it is understood, £1000 per annum; being exactly double that paid in Stirling. Mr. Smith came from Selkirk to Stirling about a dozen years ago, with the very highest of testimonials in his favour; but experience has shown that the man was rather better than his credentials. He took entire charge of the undertaking at a critical period in its history; and under his direction the whole gas-works have been remodelled and nearly doubled in size. At the present moment, the plant is one of the most efficient installations in the country; and in recent years Stirling has been a sort of gas Mecca, to which engineering experts have made pilgrimages. The output at the gas-works has more than doubled during Mr. Smith's tenure of office; and the dividends of the Company have never been so high as at the present moment. Mr. Smith has the entire confidence, not only of his employers but of his brethren in the gas engineering profession; and last year they conferred upon him the highest honour in their power, by electing him President of the North British Association of Gas Managers. He is to be heartily congratulated in having been selected to fill such a high office as that of Gas Manager under the Belfast Corporation. The Stirling Gas Directors are genuinely sorry at the prospect of parting with Mr. Smith.

THE QUALITY OF LONDON GAS.

In the Year 1909.

PARTICULARS have been given in earlier articles of the results of the testings made in the official testing-places of the London County Council of the quality of the gas supplied by the three Metropolitan Companies, for each quarter of the year 1909.* A review, however, of the average, minimum, and maximum results for the whole year may be convenient for reference; and the figures will accordingly be given in the following tables, in which the corresponding figures for the two preceding years are added for comparison.

Illuminating Power.

Table I shows the average illuminating power for each year of the gas supplied by the three Companies, both in regard to the testings made with the standard argand burner (No. 2 "Metropolitan"), and those made for "information" only by the flat-flame burner prescribed by the Gas Referees. The prescribed flat-flame burner in 1907 was Bray's "No. 7 Economizer," fitted over a Bray's "No. 4 Regulator," and in 1908 and 1909 Bray's "$\frac{G}{L}$–5 ft. $\frac{15}{10}$." Table II. shows the minimum results reported for the testings of illuminating power with the standard argand burner for each of the three Companies.

Throughout the three years, the prescribed illuminating power as tested by this burner has been 14 candles for the South Metropolitan and Commercial Companies and 16 candles for the Gaslight and Coke Company. No forfeiture is, however, incurred by the Companies for a deficiency of less than ½ candle in illuminating power. Moreover, the illuminating power of the gas for any day on which the average result of the day's testings shows a deficiency not exceeding 1 candle is, according to the London Gas Act of 1905, defined as the average of the results of all the testings made at the same testing-place on that day and on the preceding and succeeding days. Hence, it is only when the minimum result of the testings of illuminating power at any testing-place on one day shows an illuminating power of 1 candle less than it ought to be that the Company are liable forthwith to incur a forfeiture in respect of the deficiency in the illuminating power on that one day. If the deficiency is less than 1 candle, they have the benefit of any excess of illuminating power on the preceding and following days to raise the average above the figure which is the minimum to which they can work without liability to forfeiture. Owing to the complexity introduced by this provision, which was inserted in the London Gas Act of 1905, to prevent the Gas Companies incurring a forfeiture for a mere momentary drop in illuminating power, it is impossible to say from the figures given in the official returns of testings by the London County Council that the Companies have in any case in which the deficiency is less than 1 candle rendered themselves liable to forfeiture.

It may, perhaps, be mentioned that the number of testing-places controlled by the London County Council is as follows: For the Gaslight and Coke Company, eleven; for the South Metropolitan Gas Company, six; and for the Commercial Gas Company, two. There are also three testing-places for the Gaslight and Coke Company's gas controlled by the Corporation of the City of London. The results of these testings are not generally accessible, and are not included in the summaries given in this article. The number of testings of illuminating power with the standard argand burner is three daily, taken at intervals of not less than an hour; and the illuminating power for the day is defined as the average of the results of the three testings.

TABLE I.—*Average Illuminating Power (Candles) over the Whole Year.*

Company.	Argand.			Flat-Flame.		
	1907.	1908.	1909.	1907.	1908.	1909.
Gaslight and Coke .	16·72	16·93	16·52	11·82	12·14	11·30
South Metropolitan	16·39	16·57	16·34	11·03	11·25	10·70
Commercial . . .	15·35	15·11	14·75	9·21	9·42	8·96

TABLE II.—*Minimum Illuminating Power (Candles) over the Whole Year (Argand).*

Company.	1907.	19 8.	1909.
Gaslight and Coke	14·83	15·79	14·03
South Metropolitan	14·30	14·06	13·93
Commercial	14·00	13·59	13·00

It will be seen from Tables I. and II. that the average illuminating power of the gas supplied by the Gaslight and Coke Company was, during the three years, very nearly ¾ candle above the standard prescribed by the Company's Acts. It would have been 0·8 candle above the prescribed standard, but for the fact that in the last quarter of 1909 the Company, by arrangement with the London County Council, worked to a 14-candle standard, thereby anticipating by a few months the drop from 16 to 14 candles which the Company's Act of last year sanctioned as from Jan. 1 last. In all the quarters of 1907, there were returns more than ½ candle below the prescribed illuminating power, and in two quarters more than 1 candle below it. In 1908, a deficiency of ½ candle was not reported on any occasion. In 1909, a deficiency of as much as ½ candle was not reported in the first quarter; but deficiencies exceeding ½ candle and exceeding 1 candle were reported in the second and third quarters respectively. In the fourth quarter of 1909, the minimum result was 14·03 candles, which is above the standard to which, as already stated, the Company were then working. The maximum results of illuminating power reported were 18·8 candles in 1907, 18·98 in 1908, and 19·32 in 1909. The flat-flame testings were made for "information" only; and there is no prescribed standard or liability to forfeiture in respect of them. The minimum results reported for the flat-flame tests on this Company's gas were 8·5 candles in 1907, 9·95 in 1908, and 7·93 in 1909 (the last quarter corresponding to a 14-candle standard of illuminating power).

The illuminating power of the gas supplied by the South Metropolitan Gas Company during the three years was on the average 2·43 candles above the 14 candles which it was required to be by the Company's Acts. The average for the year 1909 was very little lower than that for the year 1907—indicating that up to the end of last year the Company had not found it expedient, or perhaps practicable, to manufacture coal gas of lower illuminating power on the average than about 16·4 candles. The other two Metropolitan Companies were in a position to supply gas of lower illuminating power through the employment of water-gas plant, which the South Metropolitan Gas Company have never adopted. The maximum results reported for the illuminating power of the latter Company's gas were 18·7 candles in the year 1907, 19·66 in 1908, and 18·79 in 1909. The 1908 maximum figure indicates that even in London the No. 2 argand burner has been found practicable for use for testing gas of an illuminating power approaching that prescribed for Liverpool—a point on which there seemed to be some difference of opinion among the experts recently called in opposition to the Standard Burner Bill (No. 1). In no case in any of the three years did the illuminating power of the gas supplied by the South Metropolitan Company show a deficiency of as much as ½ candle; so that this Company have at no time been within measurable distance of incurring a forfeiture for deficiency of illuminating power. In fact, throughout all the three years there has been only one return of a result below the prescribed illuminating power of 14 candles, and that return was only 0·07 candle below it. The minimum results of the flat-flame testings made on this Company's gas were, in 1907, 8·9 candles; in 1908, 9·0; and in 1909, 7·65.

Omitting the results for the last quarter of 1909, when the standard to which the Gaslight and Coke Company were working was reduced, it will be seen that the 16-candle power mixed gas supplied by that Company has averaged for the three years pretty consistently ⅓ candle higher in illuminating power in the standard argand than the coal gas made by the South Metropolitan Company, who were working to a 14-candle standard. The average of the testings in the flat-flame burner was, however, higher for the Gaslight and Coke Company than for the South Metropolitan Company by 0·79 candle in 1907, 0·89 candle in 1908, and 0·89 candle in 1909. It would seem, therefore, that the mixed gas shows a slightly higher duty relatively to coal-gas in the flat-flame burner than it does in the standard argand burner; but the difference is not very great. It may be surmised that if the No. 1 "London" argand had been used in place of the No. 2 "Metropolitan," the relation between the results obtained with it and those of the flat-flame testings with the two different descriptions of gas supplied would have been totally different.

The results for the Commercial Gas Company are interesting, because the gas supplied by that Company is a mixed gas which is required to have an illuminating power of 14 candles, and is therefore comparable with the gas which the Gaslight and Coke Company have been empowered to supply since Jan. 1 last. On the average of the three years, the illuminating power in the standard argand has been 15·07 candles, which is 1·36 candles below the average illuminating power of the coal gas supplied to a 14-candle standard by the South Metropolitan Company. The mean illuminating power in the flat-flame burner is 9·20 candles, which is 1·8 candles below the mean illuminating power in the flat-flame burner of the South Metropolitan Company's coal gas. In no quarter of 1907 did the Commercial Company's gas fall below the prescribed standard of illuminating power; but in two quarters of 1908 results were reported which were below it to an extent of less than half-a-candle. In 1909, results were reported in all the quarters below the prescribed standard—in one quarter to an extent of less than ½ candle; in two quarters to an extent exceeding ½ candle, but less than one candle; and in the fourth quarter to the extent on one occasion of exactly one candle. The maximum results reported have been, in 1907, 18·8 candles; in 1908, 17·55; and in 1909, 17·82. The minimum results with the flat-flame burner have been 7·4 candles in 1907, 7·3 in 1908, and 7·52 in 1909.

Calorific Power.

The testings for calorific power have been made for "information" only on the gas supplied by all three Companies; and one test has been made at each testing-place daily, except that

* See "JOURNAL," Vol. CVI., p. 81; Vol. CVII., p. 304; Vol. CVIII., p. 101; and Vol. CXI., p. 98.

Sundays are excluded by the London Gas Act of 1905 in so far as these "information" testings are concerned. The average, maximum, and minimum results of the testings of the net calorific power of the gas are shown in Table III. for each year for each of the three Companies. The gross calorific power has only been reported since the last few weeks of 1908. The average, maximum and minimum results of all the testings for gross calorific power in 1909 are shown in Table IIIa.

Since the Companies have not been required to work to any standard of calorific power, and have not been liable to any forfeiture in respect of low returns of the calorimetric testings, the results reported are interesting mainly in their bearing on the standard of calorific power to which gas undertakings may subsequently be required to work. In regard to the Gaslight and Coke Company, readers of the "JOURNAL" are well aware that, in their Act of 1909, the Company accepted, as from Jan. 1 last, the imposition of a standard of calorific power with liability to forfeiture in the event of a deficiency being proved. The standard prescribed in the Act is nominally 125 calories net per cubic foot; but the Company incur no liability unless they supply gas of less than 112½ calories net per cubic foot. If one testing at any testing-place gives a result below the latter figure, a second testing has to be made after an interval of not less than one hour; and the average of the two testings is taken as the calorific power of the gas on that day. If this average is less than 106½ calories, the Company are forthwith liable to incur forfeiture; but if the average for the day is between 106½ and 112½ calories, the average of the results obtained on that day and on the preceding day and on the following day is to be taken as representing the calorific power of the gas on that day, instead of the actual average of the testings made on the day. Hence, if the deficiency shown by the testings made on any one day is less than 6 calories, the Company have the benefit of any surplus of calorific power on the preceding and following days, in computing the statutory calorific power which is to be taken in assessing the Company's liability to forfeiture. It is only when the net calorific power of the gas falls below 106½ calories that the Company are liable to forfeiture on the "catch-penalty" testings made on any one day.

TABLE III.—*Net Calorific Power (Calories per Cubic Foot) over the Whole Year.*

Company.	Average.			Maximum.			Minimum.		
	1907.	1908.	1909.	1907.	1908.	1909.	1907.	1908.	1909.
Gaslight and Coke .	132·8	131·7	128·8	157·4	158·4	144·6	119·3	118·3	116 0*
South Metropolitan .	133·3	133·6	132·1	152·2	151·3	152·7	120·9	121·6	117·3
Commercial . . .	127·6	126·5	125·6	143·4	139·2	136·5	116·2	114·6	115·2

* During the last quarter of 1909, the minimum result at one testing-place was omitted in one weekly report.

TABLE IIIa.—*Gross Calorific Power (Calories per Cubic Foot) for 1909.*

Company.	Average.	Maximum.	Minimum.
Gaslight and Coke	144·3	162·0	129·9
South Metropolitan	148·9	170·3	130·3
Commercial	140·8	151·7	130·0

It will be seen from the results shown in Table III. that the South Metropolitan Gas Company have consistently supplied their coal gas to an average calorific power about 8 calories above the standard now named for the 14-candle gas of the Gaslight and Coke Company. But it must be remembered that the average of 133 calories on the South Metropolitan Gas Company's supply over the three years corresponds to an average illuminating power of 16·43 candles; and if it were found feasible to produce coal gas of 14-candle power no doubt it would have a rather lower calorific power than that of the gas supplied by the South Metropolitan Company. Excluding the last quarter of 1909, the average net calorific power of the gas supplied by the Gaslight and Coke Company was about 131½ calories, which corresponded to an average illuminating power for the mixed gas supplied of 16·8 candles. On the other hand, the average net calorific power of the mixed gas supplied by the Commercial Company to a 14-candle standard was 126·6 calories, which corresponded to an average illuminating power of 15·07 candles. Thus, comparing the figures for the Gaslight and Coke Company and those for the Commercial Company, it will be seen that a difference of very nearly 1¾ candles in illuminating power is, with mixed gas, attended by a drop of almost 5 calories in the net calorific power. If, therefore, the Gaslight and Coke Company were to supply gas to exactly 14 candle power (as their present Act requires), it may be estimated from past results that the average net calorific power would fall to about 123·8 calories per cubic foot, which is a lower figure than is named in their Act as the nominal standard of calorific power. It is the minimum result, however, which will determine the liability to forfeiture of any gas company who have a prescribed standard of calorific power. It will be seen that in none of the three years was there a minimum result reported for either of the three Companies lower than 112½ calories, which is the forfeiture standard of the Gaslight and Coke Company. It may be that in the fourth quarter of 1909 a result lower than this figure was obtained, but not reported, as the minimum is omitted in one week's report for one testing-place. Some of the figures, however, were not much above this standard. It will be noticed from Table IIIa, that there is a difference of about 8 calories in the gross calorific power between the coal gas supplied by the South Metropolitan Company and the mixed gas supplied by the Commercial Company, though both the Companies were working to a 14-candle standard of illuminating power.

Sulphur.

The average of the results of the sulphur testings and the maximum results are shown in Table IV. for the three Companies for the three years. It will be seen that the average shows an appreciable decrease in the past year as compared with previous years so far as the Gaslight and Coke Company and the South Metropolitan Company are concerned. The maximum results, however,

TABLE IV.—*Sulphur (Grains per 100 Cubic Feet) Contained in Gas.*

Company.	Average.			Maximum.		
	1907.	1908.	1909.	1907.	1908.	1909.
Gaslight and Coke .	41·2	40·7	35·4	81·6	74·9	58·8
South Metropolitan .	47·1	48·0	43·1	97·2	98·7	107·3
Commercial . . .	32·3	28·5	34·0	61·1	57·2	72·2

continue to be erratic; and an exceptionally high figure was reported in the course of last year for the gas supplied by the South Metropolitan Gas Company. The other two Companies, having the benefit of the comparative freedom of water gas from sulphur, naturally are always able to work to a lower standard of sulphur impurity than the South Metropolitan Company, who do not use any water gas.

In the First Half of the Year 1910.

The figures for the first half of the present year are specially interesting, because of the reduction in illuminating power from 16 candles to 14 candles of the gas supplied by the Gaslight and Coke Company which was sanctioned as from Jan. 1, 1910, by that Company's Act last year. Actually, as already mentioned, the London County Council had agreed to the reduction being effected in the last quarter of 1909, so that it may be supposed that the Company had already, by Jan. 1, had sufficient time to accommodate their working arrangements to the new conditions, and that the supply during the last six months is really representative of their settled practice in these conditions.

Illuminating Power.

The illuminating power of the gas supplied by the three Companies during the first half of the present year is shown in Table V., in which are also given, for the sake of comparison, the figures for the corresponding halves of the years 1908 and 1909.

TABLE V.—*Illuminating Power (Argand) for the First Half of the Years 1908-1910 (Candles).*

Company.	Average.			Minimum.		
	1908.	1909.	1910.	1908.	1909.	1910.
Gaslight and Coke .	16·84	16·74	15·27	15·79	15·37	13·88
South Metropolitan.	16·39	16·50	15·93	14·06	14·50	14·00
Commercial . . .	15·12	14·85	14·60	13·90	13·07	13·59

The actual periods referred to are the twenty-six weeks ending in 1908 on June 27, in 1909 on June 26, and this year on the 2nd inst. It will be seen that the fall of 2 candles in the standard of illuminating power enacted for the Gaslight and Coke Company has been translated in practice into a drop in the average illuminating power of the gas of only 1·52 candles. This is a good illustration of the fact, well known to gas managers, but hardly appreciated by opponents of gas undertakings, that a company rarely are in a position, even if they so desire, to take full advantage of any measure of relief they may secure in their statutory obligations in regard to the quality of gas to be supplied. The average illuminating power of the gas of the South Metropolitan Company shows a drop of about half-a-candle as compared with 1908 and 1909; and while it still remains 1·93 candles above the 14-candle standard, it is worth notice, as showing that the Company are at last effecting an appreciable reduction in the illuminating power of the coal gas which they supply. Hitherto the returns have indicated that it was not feasible to produce coal gas averaging less than 16-candle power, as tested by the No. 2 "Metropolitan" argand; but now that a definite reduction has been achieved, gas men will watch subsequent reports with interest to see if it is progressive until coal gas more nearly conforming to a 14-candle standard shall be produced. The Commercial Gas Company have succeeded in manufacturing mixed gas with an average illuminating power less in excess of statutory requirements than formerly. In the first quarter of the present year, of the three Companies only the Commercial had a minimum return below 14 candles; and in their case the deficiency was less than half-a-candle. In the second quarter, only the Gaslight and Coke Company had any return below 14 candles; and the deficiency shown by that return was less than half-a-candle. It will be seen, therefore, that all three Companies amply fulfilled their statutory obligations in respect of illuminating power during the past six months.

Flat-flame gas-burner testings have not been carried out daily by the London County Council during the present year, as was formerly the case; and consequently the average results of the testings made spasmodically with the flat-flame burner are not strictly comparable with the average results of the more frequent argand burner testings. For this reason, and on account also of their constantly declining importance, we are not collecting them in tabular form as previously. The average results of the few testings made with the flat-flame burner on the gas supplied by the Gaslight and Coke Company were 9·56 candles in the first, and 9·07 candles in the second quarter of this year. The corresponding figures were for the South Metropolitan Gas Company, 10·08 and 10·35 candles, and for the Commercial Gas Company 8·48 and 8·74 candles. In all cases, these testings show a drop on those for the corresponding quarters of previous years rather greater than the fall in the illuminating power of the gas as ascertained by the No. 2 "Metropolitan" argand.

Calorific Power.

The averages of the results of the testings of calorific power are shown in Table VI. Both the gross and net values are given, except for the first half of 1908, when the gross calorific power was not reported. The most noteworthy feature in the table is the fall in the calorific power of the gas supplied by the Gaslight and Coke Company, contemporaneously with the drop in the statutory illuminating power from 16 to 14 candles. The net calorific power now averages 123·2 calories per cubic foot, or

TABLE VI.—*Average Calorific Power (Calories per Cubic Foot) for the First Half of the Years* 1908-1910.

Company.	Gross.			Net.		
	1908.	1909.	1910.	1908.	1909.	1910.
Gaslight and Coke .	..	145·9	138·6	131·7	130·3	123·2
South Metropolitan.	..	150·0	147·2	132·7	132·9	130·9
Commercial . . .	..	141·2	138·0	127·3	126·0	123·0

practically the same as that of the similar mixed gas supplied by the Commercial Company. This is lower than the returns for the latter Company in the past would have led us to expect (*vide supra*, where it was estimated from earlier returns that mixed gas of 14-candle power would have a net calorific power of 123·8 calories), and lower by nearly 2 calories than the nominal standard prescribed in the Gaslight and Coke Act of 1909. The 123·2 calories of the Gaslight and Coke Company, however, corresponds with an actual average illuminating power of 15·27 candles (*vide* Table V.), and the 123·0 calories of the Commercial Gas Company with an actual 14·60 candles. Careful comparison of these figures with those published in previous years for mixed gas of higher quality indicate that in present conditions of manufacture the average net calorific power of mixed gas of exactly 14-candle power would be about 117 calories per cubic foot, or some 8 calories below the 125 calories which was named in the Gaslight and Coke Company's Act as a sort of standard to which it was hoped 14-candle gas might aspire. It is clear from these considerations that the statements made by Mr. Corbet Woodall and Mr. W. J. A. Butterfield in their evidence recently, that the standard of calorific power enacted for the Gaslight and Coke Company was considerably higher than corresponded with mixed gas of 14-candle power, have been more than justified by the results of recent testings in the County of London.

The calorific power of the coal gas supplied by the South Metropolitan Company shows a slight fall in the past half year as compared with previous returns. It remains, however, some 8 calories higher than that of the mixed gas of the two other London Companies. The minimum returns of calorific power in the first half of the three years are shown in Table VII. It will be seen that the Gaslight and Coke Company, with a minimum return of 112·6 calories net, just escaped falling below the 112½ calories, which is the lowest figure to which the gas may fall without the Company becoming liable to incur a forfeiture (*vide supra*).

TABLE VII.—*Minimum Calorific Power (Calories per Cubic Foot) for the First Half of the Years* 1908-1910.

Company.	Gross.			Net.		
	1908.	1909.	1910.	1908.	1909.	1910.
Gaslight and Coke .	..	132·2	126·6	121·0	117·5	112·6
South Metropolitan.	..	134·3	135·8	121·6	122·3	120·8
Commercial. . .	..	130·0	118 3	114·6	115·2	106·1

The Commercial Company, on the other hand, had a return of 106·1 calories, which is lower than the 106½ calories which constitutes the one-day "catch penalty" limit for the Gaslight and Coke Company. The lowest return of illuminating power for the Commercial Company in the week in which the return of 106·1 calories net occurred was 14·08 candles. The Company do not become liable to incur a forfeiture in respect of a deficiency in illuminating power unless the average of three consecutive days' testings is not above 13½ candles, or of one day's testings not above 13 candles (*vide supra*). Yet with a margin of over 1 candle in respect of illuminating power, the Company would, if they were bound by the provisions of the Gaslight and Coke Company's Act of last year in regard to calorific power, have become liable last quarter to a forfeiture for deficiency of calorific power. Here, again, we have conclusive proof that the standard of calorific power fixed by that Act is too high for gas which is required to have an illuminating power of only 14 candles.

The standard of calorific power to which German gas undertakings are now generally working (voluntarily) is 5000 calories gross per cubic metre at 0° C., 760 mm., and dry. This is just equivalent to 522½ B.Th.U., or 131·6 calories gross per cubic foot measured in English conditions. It will be seen that the gross calorific power of the mixed gas supplied in London during the last half year averaged 6½ to 7 calories per cubic foot above the German standard, and that of the coal gas averaged 15½ calories above it. The minimum return for the coal-gas supply was also well above this standard; but the mixed gas of both the Gaslight and Coke Company and the Commercial Company fell appreciably below it on occasions. The view previously expressed in these columns, that the calorific standard provisionally recognized in Germany is too high for application to English conditions of working and of penalty-testing, is therefore fully upheld by recent returns of the testings made in London.

Sulphur.

The average and maximum figures for the results of the testings for sulphur are shown in Table VIII. for the first two quarters of the present year. There is a slight fall in the average amounts

TABLE VIII.—*Sulphur (Grains per* 100 *Cubic Feet) Contained in Gas for the First Half of* 1910.

Company.	Average.		Maximum.	
	First Quarter.	Second Quarter.	First Quarter.	Second Quarter.
Gaslight and Coke	34·9	35·0	68·5	59·3
South Metropolitan. . . .	36·2	32·8	70·7	68·6
Commercial	29·5	28·9	43·2	52·7

of sulphur found in the mixed gas of the Gaslight and Coke Company and the Commercial Company, as compared with the corresponding quarters of previous years. The coal gas of the South Metropolitan Company, however, shows a remarkable diminution in sulphur. The fall in the case of this Company set in about a year ago, and has been steady and continuous, as the following averages for the last six quarters show :—

	1909.				1910.	
Quarter . . .	First.	Second.	Third.	Fourth.	First.	Second.
Sulphur. Grains per 100 cub. ft. .	46·5	46·2	41·0	38·6	36·2	32·8

It will be seen that this coal gas now contains on the average no more sulphur than the mixed gas of the two other Companies. It would be interesting to know to what change in methods of purification or of working the decline in the average proportion of sulphur in the gas is due. The maximum sulphur returns for this Company are also commendably low as compared with those of previous years.

A Visit to the Glenboig Fire-Clay Works.

On the occasion of the recent annual meeting of the Society of Chemical Industry in Glasgow, a party consisting of members interested in the manufacture of fire-clay visited the works of the Glenboig Union Fire-Clay Company, Limited, at Glenboig. They were received by Mr. James Dunnachie, the Chairman and Managing-Director of the Company, and were shown over the works by Mr. Douglas, the Manager, and Mr. Allan, the principal of the office staff. An inspection was first made of the chemical laboratory, and a description was given of the sampling and testing of the raw material preparatory to its selection and preparation for use in the making of bricks, blocks, retorts, &c.; and the particular method of manipulation required for each product was explained. A tour of the works was then made; the visitors inspecting the moulding, finishing, drying, and firing of the goods. Much interest was evinced in the building and handling of gas-retorts, and in the special character and composition of the clay used. Another prominent feature of the visit was witnessing in operation the burning of fire-bricks by producer gas in the Dunnachie patent regenerative gas-kiln; the method of attaining the necessary high temperature; the quality of the goods fired, and the efficiency and economy of the system being readily recognized. Light luncheon was provided, after which Mr. Eustace Carey, on behalf of the members, thanked the Glenboig Company and their officials for the facilities given for inspecting the works, and expressed the pleasure afforded by the visit. Mr. Douglas replied on behalf of the Company.

General View (taken from the Gasholders) of the Gennevilliers Gas-Works

TWO PARIS GAS-WORKS.

In the review of the proceedings at the recent Paris Congress of the Société Technique du Gaz which appeared in the "JOURNAL" for the 28th ult., it was mentioned that visits were paid to the new gas-works of the Société d'Éclairage, Chauffage, et Force Motrice at Gennevilliers and to the works at Le Landy of the Paris Gas Company. We now give some particulars of each of these works, for the photographs to illustrate which we are indebted to M. René Masse, the General Manager of the former Company, and to M. Rouland, the Managing-Director of the latter.

THE GENNEVILLIERS GAS-WORKS.

The Société d'Éclairage, Chauffage, et Force Motrice commenced operations on Jan. 1, 1906, at which date they had to supply 68 of the suburban districts of Paris, having a population of 851,000. Previously, 60 of these districts had been served by the old Paris Gas Company, whose concession expired on Dec. 31, 1905. The 68 districts covered an area of 86,500 acres, and their outer boundary line was about 108 miles long. On Jan. 1, 1910, the Society's concessions extended to 83 districts, having a superficial area of 105,700 acres, and a population of 1,031,400. When the Society started, they had 48,841 consumers, served from 625 miles of mains, on which were also 14,390 public lamps. On Dec. 31, 1906, the figures were: Gas consumers, 65,357; length of mains, 937 miles; public lamps, 18,652; and gas consumption, 1819 million cubic feet. At the close of last year, the figures stood as follows: Consumers, 138,652; length of mains, 1194 miles; public lamps, 27,346; and gas consumption, 3067 million cubic feet.

The manufacture of gas is carried on in works which are equally well situated for access by rail or river, and are sufficiently large and are equipped with plant powerful enough to meet future development. There are, in fact, two exactly similar gas-works; but they are so arranged that, should necessity arise, they can act independently. At the commencement, their productive capacity was 7 million cubic feet per day. But it is now 14 millions; and this could be doubled with the plant and land at disposal. They occupy an area 142 acres in extent, and are situated just below Paris, at the intersection of the new line of the Northern Railway and the Seine. This line connects with the Girdle Railway, so that coal-trucks can be easily run into the works; and the river brings up colliers from the North and the Pas de Calais and lighters from the steamers at Rouen.

In order to ensure the regular distribution of the gas, which is manufactured at a place outside the area to be served, three supply stations have been established. One is at Gennevilliers, and consists of two gasholders, each of rather more than 2 million cubic feet capacity*; and the others are respectively at Alfortville and Boulogne-sur-Seine, at each of which places there is a holder of similar capacity to those at Gennevilliers. To feed the latter holders, which are situated 11½ and 16¾ miles from the works, compressing plant has been erected there, and also suction plant in each of the holder stations, in case of any mishap at the point of output of the gas. These three centres of distribution are connected by two mains—one a trunk main running from Gennevilliers to the two holder stations without being tapped on the way; and the other the principal supply main serving the branches leading to the network of pipes in each district. The chief distributing mains, which are of cast iron and have special india-rubber joints, are all 24 inches diameter; and their length is 38½ miles.* The principal west trunk main is a 28-inch one at Gennevilliers, and is reduced to 20 inches at Boulogne; the east main starts at 40 inches, and is reduced to 20 inches at Alfortville. The total length of these mains is 39 miles. In addition to the principal mains there are, of course, a number of secondary trunk and distributing mains. For an hourly output of about 176,000 cubic feet of gas, the pressure in the trunk mains does not exceed 28 inches of water. By means of compressing and other plant, the holder stations can be supplied at the rate of about 353,000 cubic feet per hour.

Having given some general particulars in regard to the Society, we will describe the leading features of the works.

Coal Unloading and Carbonizing Plant.

Parallel with the River Seine there has been constructed in reinforced concrete a landing-stage 1000 feet long, which allows of the mooring at one time of seven lighters of 280 tons capacity, or five large colliers capable of carrying from 800 to 1200 tons. On the landing-stage are three electric cranes of 40 tons and one of 60 tons per hour, with a steam crane in reserve. There are likewise an arrangement of movable shoots for filling boats with coke; a towing-vessel of 25-H.P.; a pump-room containing a centrifugal pump of 150 tons capacity per hour and a force-pump of 10 tons capacity; and a small general room, with store, an office containing a weighing-machine, clothes and refreshment room, &c. The men engaged at the landing-stage are trained to plunge into the water cork-jacketed in order either to save life or to execute repairs to the structure or the boats.

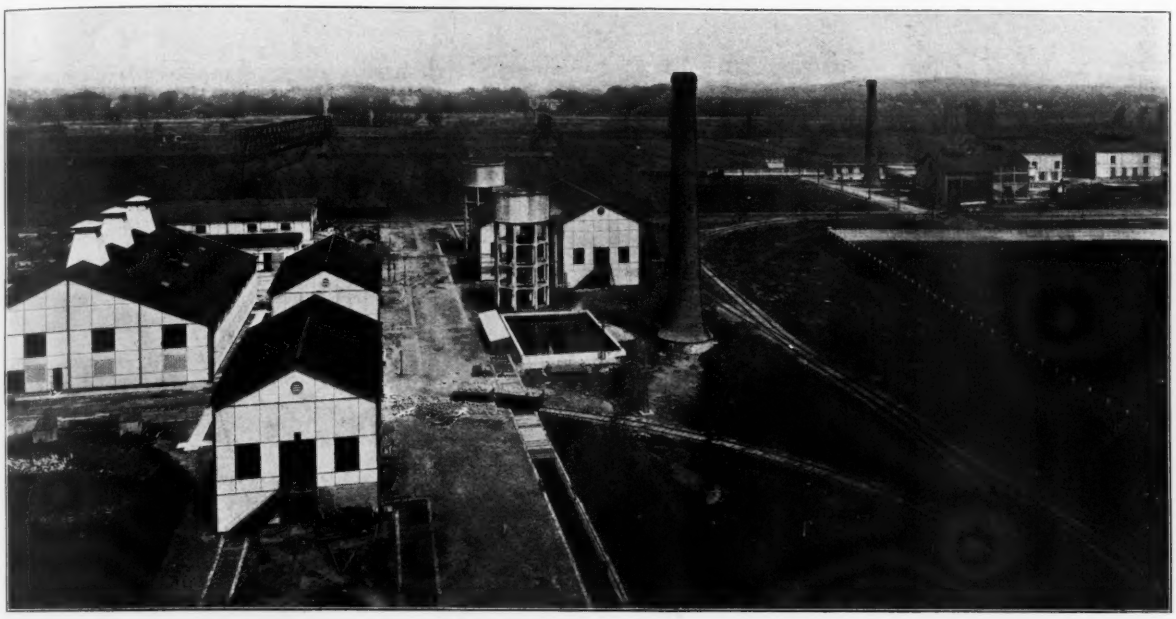
There are four retort-houses. Nos. 1 and 2, which were constructed in 1905, are alike, each having eight benches of three settings of nine 20-feet horizontal retorts—a total of 216 per house, or 432 for the two houses. No. 3, erected in 1906, contains four benches of six settings of nines similar to those in the other houses, giving a further 216 retorts. The furnaces in these three houses are all on the recuperative system. No. 4 house is equipped with inclined chamber settings of the Munich type, comprising two benches of ten furnaces erected in parallel, with three chambers, or 60 chambers in all. They were put up in 1908-9, and brought into use towards the close of last winter.

Nos. 1 and 2 retort-houses are parallel, and separated from each other by a passage 41 feet wide and 395 feet long, in which are the coal-bunkers. No. 3 house is similarly served; and provision is made for No. 4. The capacity of these bunkers is 5000 tons per house, or sufficient for about ten days' work. The charging-machines employed in Nos. 1 to 3 houses are of the De Brouwer, Sautter-Harlé, and Cabrier types; the two former also discharging. In Nos. 1 and 2 houses, the coke is removed by a band conveyor to inclined hoppers located outside, where it is quenched. Each of these houses is furnished with a skip elevator, which transfers the coke, after cooling, to storage hoppers of reinforced concrete constructed parallel to the retort-houses. These hoppers are of sufficient capacity to contain 36 hours' production of coke.

The fourth retort-house, as already stated, is equipped with inclined chamber settings on the Munich system. The charge for each chamber is 3½ tons; and the carbonization period is 24 hours.

* One of these holders was illustrated in the "JOURNAL" for Jan. 23, 1906 (p. 223).

* The joint referred to was illustrated in the "JOURNAL" for Jan. 8, 1907 (p. 87).



of the Société d'Éclairage, Chauffage, et Force Motrice, of Paris.

The chambers are charged and the furnaces attended to outside the house; they are discharged in the space between the two benches, in which, of course, provision is made for the removal of the coke. As the Munich chamber settings have been fully described in the "JOURNAL," it is unnecessary to give details of them again. The installation at Gennevilliers, however, has some features of interest, in connection with the extinction and removal of the coke, to which attention may be directed. On leaving the chamber the coke falls into a quenching tower, where it is subjected to a short, but very heavy, shower of water. In order to avoid the use of flexible tubing or the making of connections on the position of the tower being changed, the supply of water is obtained by means of movable syphons in troughs which are kept filled in the upper part of the house. The tower moves above a De Brouwer conveyor, on to which the coke falls after only a few minutes' interval. By this it is carried to a bucket conveyor which rises perpendicularly. The coke is finally cooled in the open air, and the buckets are made to discharge their contents at any determined place on a movable platform of a special kind, which is the subject of a patent taken out by the Society in 1908.*

Coke-Handling Plant.

The coke is conveyed to its destination either in skips mounted on trolleys or in hopper-waggons. If it is to go to the coke-ground, the former are used. If, however, it is to be screened and sorted, it is conveyed in waggons to bucket elevators, by which it is raised into the sorting-house, which consists of a series of receptacles constructed of reinforced concrete, having above them two "jigger" tables. This installation will deal with about 27,500 bushels of coke per day. The ground is nearly 10 acres in extent. The coke-handling plant includes some large inclined screens for separating the breeze from the coke, and movable dredgers by which the classified coke can be taken from the stack and put into sacks for sale.

Purifying, Measuring, and Storage Plant.

On leaving the retort-houses, the gas is conveyed by air-cooled foul mains to the condensers, from which it passes successively through the exhausters, washers, purifiers, and station meters to the gasholders. The condensers are built about 38 feet high, and 39 inches external and 24 inches internal diameter. The gas circulates in the annular portion, the air in the centre; the supply of the latter being regulated by clack-valves in the base. Each of the two exhauster-houses has a total capacity of 530,000 cubic feet per hour; the equipment being three groups of two exhausters, each group operated by a steam-engine, but arranged also for electric driving in case of need. Each of the two washer-houses contains a Pelouze and Audouin condenser, a cyanogen washer, two sets of refrigerators for bringing the gas down to suitable temperature, and an ammonia washer. There are three purifier-houses, each of a capacity of from 5½ to 7 million cubic feet of gas per 24 hours. The two houses first constructed, dating from the starting of the works, each contain eight boxes about 30 feet square with hydraulic seals. They are located on the first floor; the purifying material being prepared on the ground level and revivified on the second floor, to which it is raised by skips worked by a travelling crane. The third purifier-house, finished this year, contains eight purifiers, 48 ft. 9 in. by 17 ft. 9 in., with dry joints. These purifiers are on the ground level, and occupy half the house; the other half being utilized for the preparation and revivification of the material. The two station-meter houses each contain two meters of rather more than 3 million cubic feet daily capacity, with room for a third. The two holders (referred to at the outset) have each three lifts; the last rising above the guide-framing. They work in wrought-iron tanks. Between the two there is plant for heating the parts of the tank liable to be affected by frost.

Emission, Compressing, and Enriching Plant.

The gas is sent out from the works in three trunk mains in the direction of Alfortville, Boulogne-sur-Seine, and St. Denis. Some particulars of these mains have already been given. The compressing plant occupies a special building. It consists of three groups of rotary compressors, of a capacity of 176,000 cubic feet per hour. Each group comprises two compressors coupled to one steam-engine, but arranged for being separately driven by electric motors. One group compresses the gas going to Alfortville, another that for Boulogne, and the third is kept in reserve. Two return governors complete the installation.* The gas is benzolized at Gennevilliers, Alfortville, and Boulogne. At the first-named station there are complete experimental gas-works of a capacity of about 210,000 cubic feet per day.

Transporting Plant, Rolling Stock, and Motive Power.

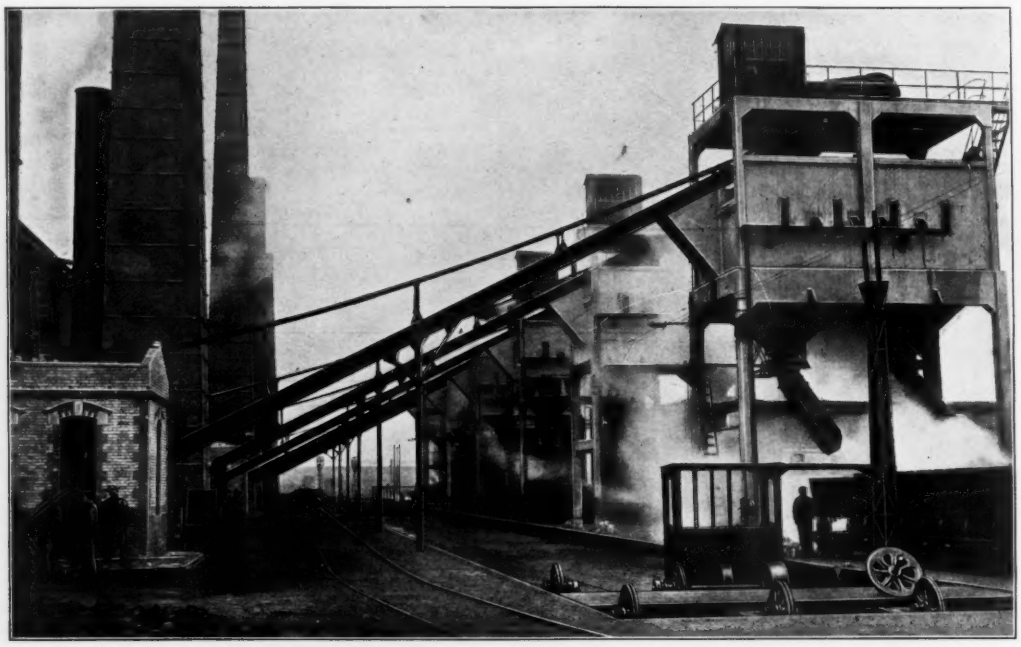
The transporting plant was shown in the views of the works given in the "JOURNAL" for the 1st of March last, which were taken when the place was under water. There are four transporters—two for the coal and two for the coke ground—each of a capacity of from 600 to 800 tons per day of ten hours. The coal-transporters have one crane only; while those used for moving the coke have two, each about 50 feet long. There are at the present time something like 15 miles of lines upon the works. The rolling-stock comprises five steam locomotives, each of 150-H.P. effective, and equal to a load of 21 tons; 25 hopper trucks, opening at the bottom; and 30 large and small trolleys. The motive power consists of two sets of plant—one consisting of three boilers placed near the retort-houses; and the other of six boilers, located in a building situated behind the engine-room. The boilers are heated exclusively by coke breeze. The continuous current at 500 volts which is utilized in the works is produced by three turbo-generators, each of 400-kilowatt power at 2000 revolutions. The current is distributed by a switchboard placed in the engine-room. The water for the supply of the works is drawn from wells or from the Seine, and is distributed by means of electric pumps.

Products Works.

The works for the treatment of the residual products comprise a sulphate of ammonia house, tar distillery, sulphuric acid plant, and laboratory. The sulphate plant consists of two sets of apparatus exactly alike (the saturator being of the Society's own special design), each capable of dealing with some 26,500 gallons of liquor per 24 hours. The salt is stored in receptacles constructed of reinforced concrete, capable of holding about 800 tons. The tar-distilling plant is also in two sets, each consisting of one preparatory boiler and two stills, each of 40 tons capacity. The heavy oils are run into four vats of reinforced concrete, which will hold about 440,000 gallons; and there are three small sheet-iron reservoirs for the light oils. There are four pits for the reception of the pitch, and they will contain altogether 3500 tons. There is nothing special about the sulphuric acid plant.

*See "JOURNAL," Vol. CIV., p. 213.

* The compressing and exhauster plant was illustrated in the "JOURNAL" for Jan. 29, 1907 (p. 278).



Coke Towers and De Brouwer Conveyor at the Paris Gas Company's Station at Le Landy.

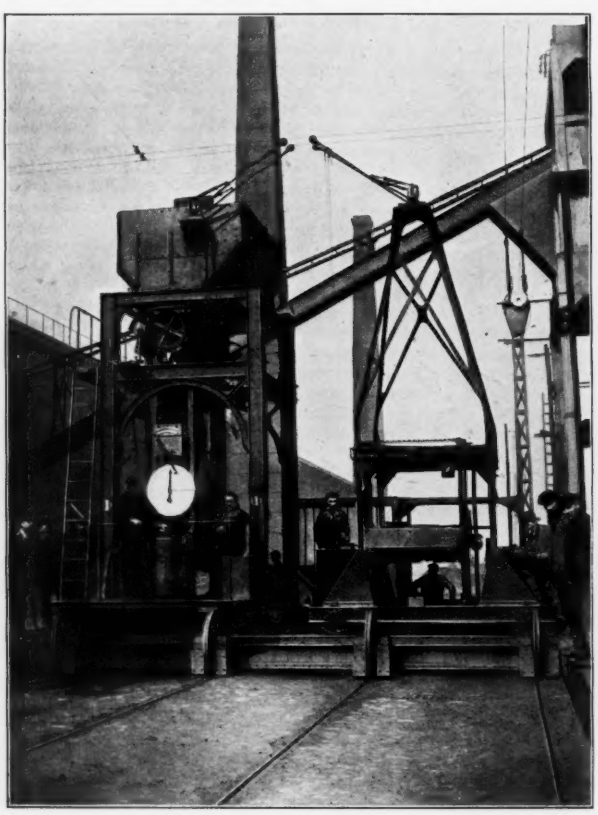
Other Features of the Works.

A feature of the Gennevilliers works is the collection of motor-waggons used for the delivery of coke sold by retail. There are fifteen of them of 24-H.P., with four twin cylinders, weighing when empty rather more than $3\frac{1}{2}$ tons, and taking a load of nearly equal weight; and one, of the Society's special type, of 30-35-H.P., weighing $4\frac{1}{2}$ tons empty, and carrying a load of 5 tons. These motor-waggons ensure deliveries of coke within a radius of eight to nine miles of the works, and they dispose of as much as 150 to 180 tons a day. There are, in addition, three similar waggons for outside service, located at Alfortville and Boulogne. One of these vehicles is ready for use, night or day, in case of accident.

It only remains to say that these very fine works include dwelling-houses for the Engineer (M. Raoul Frère) and the principal officers, who have the use of a plot of land outside the boundary wall for cultivation; an infirmary; a fire service of 40 men; and a musical society with a like membership. There are also benefit, provident, and pension funds for the employees. On the occasion of the visit of the Société Technique members last month, the firemen and musicians afforded them an opportunity of judging of their efficiency; and both displays evoked well-merited approbation.

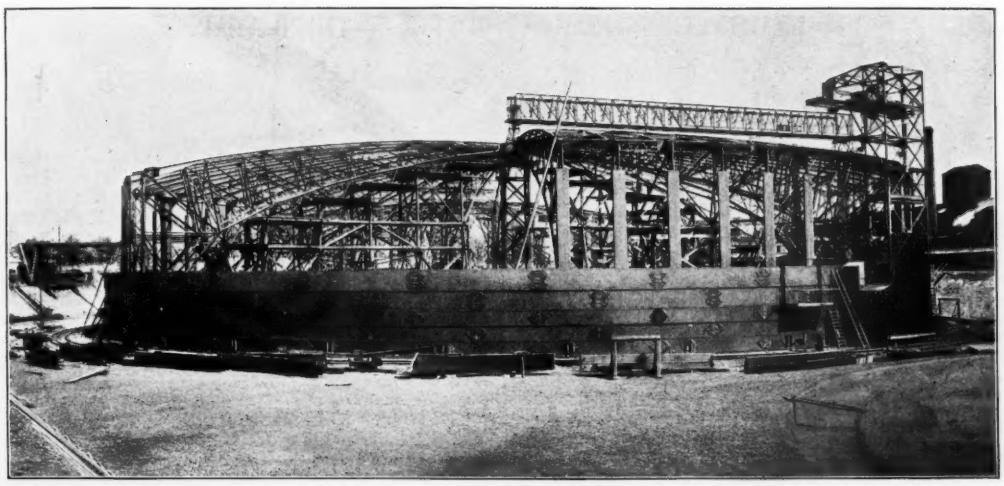
THE PARIS GAS COMPANY'S WORKS AT LE LANDY.

The gas-works at Le Landy, a north-eastern suburb of Paris, are the most recent of those constructed by the old Paris Gas Company—having been erected in 1889. Their superficial area is about 118 acres. Up to within the past few years, there was only one retort-house, containing 648 ten-feet hand-stoked retorts; the daily production of gas being rather more than 6 million cubic feet per day. The Company's concession expired on Dec. 31, 1905; and their successors, the Société du Gaz de Paris, put up in 1908 a second retort-house of similar capacity to the other, but equipped with mechanical stoking appliances. Last year they altered the



Charging and Drawing Machines at Le Landy.

Coal Hoppers and Conveyor at Le Landy.



One of the 5¼ Million Cubic Feet Gasholders in Course of Construction at Le Landy.

old house to machinery; and by the end of the current year the works will possess four houses all alike, with a total productive capacity of nearly 24¾ million cubic feet of gas per day. Shortly afterwards, sister works, of like capacity, will be commenced on a contiguous site, almost as extensive as the other; and they will include products works and a tar distillery.

Coal Supply and Carbonization.

The coal is delivered into the works by rail and water—the former being a branch of the Northern Railway, and the latter the St. Denis Canal. It is removed from the barges by means of two steam-cranes of a capacity of 300 tons per day of ten hours. When the works in hand are completed, the quantity of coal carbonized per annum will be 600,000 tons. It is stored in the open and also in bunkers before the retort-houses; their total capacity for the four houses being about 10,000 tons. Thence it is carried by band conveyors to the breakers, from which it is raised by a Hunt conveyor to the coal-hoppers placed at the end of each bench for the supply of the charging-machines. Their capacity is 100 tons each, or sufficient for 24 hours' carbonization.

Each of the retort-houses—two of which are at work and the others in course of equipment—contains six benches of six settings of nine 20-feet through retorts, taking 11¾ cwt. of coal in eight-hour charges, which are inserted by De Brouwer machines and withdrawn by those of Sautter-Harlé. The coke is quenched and removed by a De Brouwer chain conveyor, which carries it into hoppers of reinforced concrete, whence it is taken by trains to the coke-shed. All these machines are worked by electricity.

Condensing, Purifying, and Other Plant.

On leaving the retorts, the gas passes into the hydraulic mains. The benches in No. 1 house have two independent mains, one on each front; but those in No. 2 house have only one, in the middle, with two ascension-pipes to each retort. In connection with these two houses there are two vertical atmospheric condensers; but the other houses have those of the water-cooled tubular type, two to each bench, and they are placed as close as possible to the settings. There are three rotary exhausters, two of 3 million and one of 2¼ million cubic feet capacity; and three of Beale's exhausters of 4¼ millions capacity. A new building will contain four more of them, so as to correspond with the future increase in the carbonizing plant. Battery condensers and Kirkham and ammonia washers prepare the gas for the purifiers. In four houses these are of the old type, and allow of three consecutive passages of the gas. Houses Nos. 5 and 6, in course of construction, will contain two groups of four boxes—that is, eight boxes in all, of which six will be in use simultaneously, and they will be changed in rotation. These boxes will be furnished with Jäger grids.

There are thirteen station meters—four old ones, of 1,400,000 cubic feet capacity, and nine "Duplex," equal to passing 2,100,000 cubic feet. But only three of the latter are in use. There are eight gasholders—five old ones, of the single-lift type, of about a million cubic feet capacity, and three new three-lift ones, capable of storing 5¼ millions; making a total, in round numbers, of 21 million cubic feet. On the occasion of the visit of the Société Technique, much interest was displayed in the two new holders under construction; many of the members descending into one of them to inspect the work going on.

Compressing and Delivery Plant, Etc.

The gas can be sent from the works either at the pressure given by the holders, through station governors, or at high pressure, by means of Rateau compressors. M. Laurain, the Chief Engineer of the Company, explained to the visitors that the pressure at which gas is supplied in Paris had been raised, and was generally 36-10ths; only falling to 30-10ths in the early hours of the morning. This has given much satisfaction. There are two outlet mains, each 30 inches diameter—one being for ordinary and the other for either ordinary or high pressure. Other outlet mains are in contemplation. A 28-inch main is used to convey high-pressure gas to the holders at La Villette; and another, of similar size, will eventually feed those at Clichy.

The electric energy required at the works is generated at a central station equipped with eight Niclausse boilers, worked by coke breeze, and two engine-rooms, each containing two groups of generators, horizontal compound tandem engines of 650-H.P., continuous-current compound dynamos of 400 kilowatts per 250 volts, as well as a pressure-raiser for the service of a battery of accumulators.

ASSOCIATION OF CONSULTING ENGINEERS.

A New Organization.

A Meeting was held at the Caxton Hall, last Wednesday, to consider the desirability of forming an Association of Consulting Engineers; the object being to constitute a recognized group of *bonâ fide* independent consultants for the protection of their own interests and those of the public generally, and to improve the status of the profession. Sir William Preece, a Past-President of the Institution of Civil Engineers, presided. Invitations had been issued to a number of consulting engineers, at the instance of a Provisional Committee, of which Mr. Charles Hunt and Mr. E. H. Stevenson are members, representing gas engineers, and Mr. A. H. Dykes is the Hon. Secretary.

In explaining the object of the meeting, Mr. Midgley Taylor said the question of forming an Association such as the one proposed had been before several consulting engineers for the past two years; and as some initial step had to be taken, the members who originally considered the subject formed themselves into a Provisional Committee and had held a large number of meetings, with the result that the present gathering had been called to confirm or otherwise the action taken in the past. He wished to emphasize the point that the Committee had not been working in any antagonism to the Institution of Civil Engineers, but had been endeavouring to "go one better" than was possible for that body. It was felt that the public required protection. At present, if municipal authorities erected works, even of large magnitude, they were not compelled to employ a qualified man to advise them; and there was nothing to prevent an absolutely unqualified one going to the particular authority, touting for the work, and being employed. Under these circumstances, he felt they should endeavour to form an Association such as would not only protect themselves, but would protect various public bodies and persons in this country.

A resolution in favour of the formation of the Association was then proposed by Mr. James Swinburne, and seconded by Mr. E. L. Mansergh. A general discussion followed, in the course of which Mr. E. H. Stevenson said he wished such an Association had been started twenty or thirty years ago; and though it might not now affect the older consulting engineers, like himself, it would be of the very greatest assistance to the younger ones. Sir William Preece said he was entirely in sympathy with the movement. What they wanted was to band themselves together as brothers in a similar profession, with a strong Committee and a strong Chairman. He then put the motion to the meeting, and declared it carried unanimously.

The list of names of the suggested Committee was then read, as follows: As representing Civil Engineering—Messrs. Baldwin Latham, S. R. Lowcock, E. L. Mansergh, Henry Rofe, and Midgley Taylor. Electrical and Mechanical Engineering—Messrs. Robert Hammond, B. M. Jenkin, W. M. Mordey, W. H. Patchell, Sir William Preece, J. F. C. Snell, and James Swinburne. Gas Engineering—Messrs. Charles Hunt, E. Herbert Stevenson, and Henry Woodall. No further names being forthcoming, the Committee were elected as above, with power to add to their number; and Mr. A. H. Dykes was elected Hon. Secretary, with offices at No. 1, Victoria Street, Westminster.

EXAMINATIONS IN "GAS SUPPLY"—THIRD YEAR.

Answers to the Questions Set.

[THIRD ARTICLE.]

IT has previously been pointed out that it is a most difficult problem to ascertain accurately the relative competence of students during an examination extending over only four hours. Adequate preparation for such an examination has occupied a student for many leisure hours extending over a period of something like 30 weeks. Such a system of examination always involves a slight element of luck or ill-luck for those candidates who come to the examination room inadequately prepared. They may be fortunate enough to secure a diploma which is more than they deserve; but this will be due to "striking" a set of questions upon most of which they have had the good fortune to acquire either theoretical or practical knowledge. The enthusiastic and really ambitious student will leave nothing to the caprice of luck or ill-luck. If he be an Ordinary Grade candidate, he will begin at the beginning of the syllabus, taking the items enumerated therein one by one and master thoroughly to the best of his ability the essential principles and practice underlying such items. If he is an Honours Grade student, he will first of all refresh his memory, and, if possible, his practice, in the Ordinary Grade syllabus, and then carefully attack the subjects mentioned in the Honours Grade. If the candidate is of the right metal, he will set as his ambition one of the medals which are offered for the particular grade in which he is studying. Not that the be-all and end-all of preparation is the securing of an award in the shape of a medallion, but that it is emblematical of thoroughness, and of studies which have been complete and adequate to the subject concerned. It is difficult to believe that any student can possibly secure the highest awards without the highest degree of assiduity in both his studies and his work.

Looking for a moment over the examination questions which were set in April last, it is to be observed that there is no preponderance of questions in any one phase of "Gas Supply." The last-issued programme of the Department of Technology contained, in the Ordinary Grade, ten sub-sections; and in every one of these sub-sections at least one question was set at the examination. In the Honours Grade, there were eleven sub-sections; and the questions set had relation to at least nine of these sections, as well as more advanced knowledge of certain subjects included in the Ordinary Grade syllabus. When an examiner traverses a syllabus in this way, a candidate will be more than ordinarily gifted with faith if he expects to go through the ordeal of examination with inefficient preparation.

These remarks are offered as a word in season to those students who contemplate taking the course during the coming winter, with the object of offering themselves as candidates next year. Certain coaching courses are being offered to candidates; but the most efficient coaching cannot guarantee good results unless the candidate is prepared to work. The chief advantage of a coaching course is that it tends to continuity of study in those cases where some such exterior influence is necessary to keep the student with his "nose to the grindstone." Given the practical opportunity of acquiring knowledge and the availability of suitable text-books, a student imbued with proper enthusiasm may "plough his lonely furrow" with success. Such enthusiasm, is unfortunately, rare, and as a general axiom it may be laid down that most students will be well advised to attend a regular series of lectures, or else adopt a coaching course of good repute.

Subjoined are answers to the questions set in the Honours Grade this year.

Honours Grade Questions.

1 (A). Describe fully the operation of fixing a service clamp or clamps to a high-pressure main, and give sketches of the type of clamp or clamps you would employ. What tools and fittings will be required to complete the service connection?

The form of service clamp shown in the sketch is Mueller and Co.'s "Improved National" (fig. 1). The body is of malleable cast

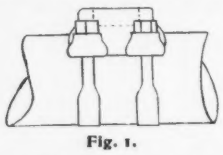


Fig. 1.

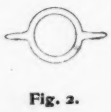


Fig. 2.

iron, with a rib cast on to strengthen it. The boss is made thick enough to give a full, deep thread for the service attachment. The clamp is kept firmly in position on the main by two bands or straps. These are secured by nuts at each corner, and are made of the best soft steel screwed at each end, and bent to exactly fit the main. A groove is left in the bed of the clamp to receive a moulded lead ring (fig. 2), the lugs of which are bent over the side of the clamp to prevent lateral movement.

To fix a service, the main is thoroughly cleaned where the clamp and service is to be attached. The lead ring is placed on the main, the straps passed underneath, and then the clamp put on the main, the groove in the bed of the clamp fitting over the lead ring. The whole attachment is then firmly secured to the main by means of the nuts. A short piece of tube is next screwed into the boss of the clamp to hold the Mueller drilling apparatus. The drill spindle passes through a stuffing-box, which keeps the apparatus gas-tight until the drill is withdrawn.

The tools required would be: Pipe-wrench, pipe-cutters, vice, hammer, chisel, spanners, screwing machine, and Mueller's patent drilling apparatus, with the usual excavating tools.

1 (B). Give sketch and description of governor suitable for reducing the gas in a high-pressure main to normal pressure, and state the precautions necessary to ensure satisfactory working.

The Johnson-Reynolds service governor (see fig. 3), is an efficient type for the purpose. X is the gas inlet, and Y the outlet. A screw W is inserted, as shown, to adjust the spring V. R is an air-vent in the top of the governor, and carried outside the premises. The diaphragm S is connected to the valve T by a lever.

The pressure from the high-pressure main is adjusted by the screw W, which works the spring and, consequently, the diaphragm and lever; thus adjusting the valve as required.

The diaphragm must be kept well softened

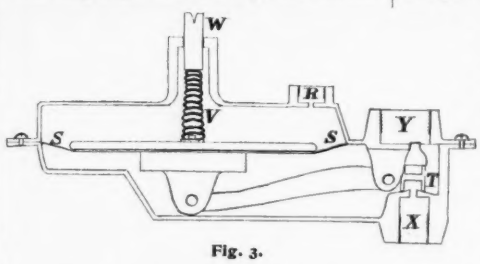


Fig. 3.

by pouring in oil at the air-vent; the dry nature of the compressed gas tending to cause the diaphragm to crack.

The valve should be kept perfectly clear of dirt or grit, as this would soon interfere with the working of the governor. As a safeguard,

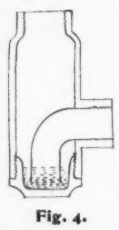


Fig. 4.

a mercury seal (fig. 4) is used, and is fixed between the governor and meter; and excessive pressure which may be thrown on the meter through failure in action of the governor is in this way avoided.

2. Show, by means of sketch in elevation, a circulating gas water-heater, with the connections to compensating tank and a hot-water radiator as used in public buildings. What fixing precautions are necessary when a complete installation is carried out. Give calculation of the gas required to heat, by hot water system, the air in a hall of the following dimensions: Total length 150 ft., width 60 ft., height to apex 25 ft., and to eaves 13 ft., assuming the rate of air change to be five times per hour and the average increased temperature required 10° Fahr.

The precautions necessary are: Water-heater (A) should be of sufficient size to meet requirements. The burner should be well constructed, and the supply of gas regulated with a thermo-valve. An adequate flue pipe should be provided, broken as shown at B, to prevent down-draughts or excessive up-draught. The pipes from the circulator (A) to the radiators (C) should be of adequate size, and sharp turns avoided.

The first radiator should be the lowest of the system, if the flow-and-return pipes can be fitted under the floor. A vertical air-pipe D should be fixed at the highest point to allow air bubbles and any generated steam to escape. The radiator, both inlet and outlet, should be fixed to the flow pipe, with a valve on the inlet so that the heat can be regulated. A pipe E should be branched from the return pipe and carried above the height of the

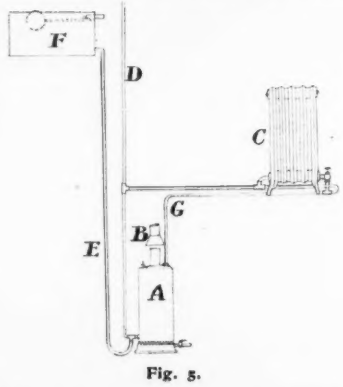


Fig. 5.

radiators, at the top of which should be a cistern F for filling in the water, and to provide room for expansion when heated. All joints must be sound, and the pipes laid with a slight fall. The hot-water pipe (G) from the circulator must be taken from its highest point; the connection being formed with a bend, not an elbow.

The gas supply pipe must be of ample size, and even pressure must be maintained.

Cubical contents of room:

150 × 60 × 12	=	117,000
150 × 6 × 60	=	54,000
Total . .		171,000 cubic feet,

multiplied by the number of times the air is changed per hour—viz., 5—which gives 855,000 cubic feet of air passing through room per hour. 855,000 × ·08 (weight of 1 cubic foot of air in pounds) gives 68,400 lbs. 1 B.Th.U. will heat 4 lbs. of air 1° Fahr. Therefore the number of

cubic feet of gas required to heat the air 10° and of 600 B.Th.U.'s net will be $\frac{68,400 \times 10}{4 \times 600}$ equals 285 cubic feet of gas per hour. Allowing an efficiency of 90 per cent. for the circulator, 31 cubic feet must be added to this, or a total consumption of 316 cubic feet per hour.

3 (A). What tests should be employed to ascertain the thermal efficiency of gas cooking-stoves and the hygienic effect upon the air of rooms?

Boiling Burners.—A copper pan with a good-fitting lid is used. Through a hole in the lid is passed a delicate thermometer, with the bulb near the top. The lid is then put on, and the temperature of the water in the pan noted; moving the thermometer about before reading. The flame is then regulated, so as not to play up the sides of the pan, which is placed over the burner. Gas burnt is measured through a test meter; the register being taken simultaneously with the placing of the pan on the burner. The temperature is raised to a certain point, which is noted, along with the consumption of gas. It takes 1 B.Th.U. to raise 1 lb. of water 1° Fahr. Therefore, by calculation, the calorific value of the gas being known, the B.Th.U. imparted to the water in the pan is obtained, and the efficiency of the burner, by comparison with the total B.Th.U. in the gas used.

Grill Burners.—A series of ⅝-inch copper tubes, all connected together, are taken and formed in such a way as to give as much surface as possible to the heat thrown off by grilling burner. At each end of the series, thermometers are fixed. A test meter is used, as before. Water is caused to pass through the series of tubes at a slow rate; the tubes being placed underneath the grilling burner, as in actual use. The temperature of the inlet and outlet water is taken; the difference noted along with the consumption of gas; and the efficiency calculated as before.

Oven Burners.—Thermometers may be inserted at a number of points through holes in the top of the cooker. The gas consumption is adjusted to a definite amount; readings of thermometers being taken each minute until a maximum is reached.

Then a sample of the flue gases may be taken and analyzed for carbon dioxide, oxygen, and nitrogen, to ascertain whether the ventilation is excessive or deficient.

In pure air, there is 20·7 per cent. of oxygen and 79·3 per cent. of nitrogen. The difference between 20·7 and the amount of oxygen found by analysis will be the quantity of oxygen used for combustion. Approximately, the degree of ventilation may be arrived at by dividing the figure of free oxygen by the figure of oxygen used. In the upper part of a gas-oven, just as in the waste travels of a regenerative setting, the analysis should show only a trace of oxygen. If amount is considerable, the damper should be decreased and test repeated.

By taking (1) atmospheric temperature, (2) temperature of flue products, (3) analysis of products to ascertain how much is passing per hour, (4) gas consumption, (5) calorific value, the relation of heat generated to heat lost in flue may be ascertained by calculation.

The information thus obtained will only be of practical service where cookers are fixed without flues. Where cookers are attached to flues, only a practical cooking demonstration *in situ* and careful observations will indicate the correct amount of ventilation required. This may be repeated for different cookers.

The efficiency will depend on the quantity of matter in the oven; but to obtain the best results, over-ventilation must be reduced to a minimum. It is obvious that the greater the quantity of matter in the oven, the greater the surface to arrest the heat, and, consequently, less proportionate waste.

The chief hygienic effect of cooking stoves on the air of rooms is the substitution of carbon dioxide for the oxygen of the air. The extent to which the carbon dioxide in the air is increased may be ascertained by means of a saturated solution of barium hydrate introduced into a Wanklyn's bottle previously filled with a sample of the air to be tested. Phenol phthaleine is used as an indicator; and the contents of the bottle, after being well shaken, are titrated with a standardized solution of oxalic acid.

3. (B.) What are the advantages and disadvantages of flue-pipes used in conjunction with gas cooking-stoves?

Advantages.

(1) Ensures smell of cooking, steam, and products of combustion being carried away (provided flue is clear and no down-draughts).

(2) Ensures ventilation of oven; thus preventing "smothering out" of burner flames by carbon dioxide.

(3) Prevents rise in temperature of room, and therefore more pleasant to the occupants.

(4) Healthier surroundings—*i.e.*, purer air.

(5) Avoids discolouration of walls, by condensed products, &c. (heated products, steam, &c., ascending the flue).

Disadvantages.

(1) Possible unsightliness.

(2) Cooling effect through over-ventilation, the rate of "pull" varying with the alteration of outside temperature, strength, and direction of wind. A damper is therefore necessary.

(3) Possibility of down-draughts, with the "smothering" or blowing out of flames, and consequent risk of explosion if light is applied.

(4) If flue gets made-up, it is sometimes difficult to clear.

(5) Dirt and soot may be blown down flue into oven.

(6) Condensation of products may take place in the flue and run back into the oven carrying dirt, &c., with it, rapidly corroding the flue, particularly if made of galvanized iron or tin.

The best and safest arrangement is a hood over the hot-plate, and the oven flue-pipe carried under it; a pipe out of the hood carrying all the products away from the oven and the hot-plate.

4. Assuming either of the two following types of gas compressors are equally convenient for lighting business premises, which would you prefer, and why: (*a*) Gas-driven rotary; (*b*) hydraulic? If a compressor of the last-named type failed, how would you proceed to ascertain the cause, and remedy defect or defects?

Gas-Driven Rotary.

Points For.

(1) Certain in action.

(2) Less risk of deposits clogging mechanism than in hydraulic type.

(3) Less time taken in overhauling.

(4) Less intricate parts to go wrong.

(5) Working depends strictly on gas supply—*i.e.*, the aid of water supply not required for motive power.

Points Against.

(1) Initial cost greater unless a gas-engine has been previously installed.

(2) More space required.

(3) Rather more costly to run.

(4) More attention required.

Hydraulic.

Points For.

(1) More compact.

(2) Less initial cost.

(3) No noise.

(4) Less ground space required.

(5) No skilled attendant necessary.

(6) Apparatus works automatically.

(7) Cheaper to run.

Points Against.

(1) Not as certain in action.

(2) There are a large number of intricate parts which may go wrong.

(3) Difficult to overhaul.

(4) Depends for its working on water pressure, which is not as convenient to correct as gas.

From the above, it would almost appear that the points for the hydraulic type outweighed those of the gas-driven type; but the writer, from experience, prefers the gas-driven rotary type, because he has found the working much more certain and accurate. It will be noted that the advantages claimed for the hydraulic type are, in the main, more trivial and of a more theoretical nature than those of the gas-driven rotary; while the disadvantage No. 2 of the hydraulic is of a serious nature. The disadvantages of the gas-driven rotary *after* the installation has been fixed and working are few and trivial.

The causes of failure and remedies for hydraulic compressors are as follows.

Cause.

(1) Stoppage of motor probably through too little water pressure, main valve too stiff, worn leathers, auxiliary valve out of stroke, deposits on piston rod.

(2) Flooding of gas-valves owing to over-taxing compressor, worn leathers, deposits in overflows, shortage of gas supply.

(3) Fluctuation in high-pressure gas owing to shortage of water pressure, a gas-valve sticking, water in the gas ports or pipe to burners.

(4) Gas passing at low pressure when motor is working.

(5) Motor working when gas is turned off at outlet.

Remedy.

(1) (*a*) See that water supply is adequate; (*b*) Loosen main valve; (*c*) Repack and adjust auxiliary valve; (*d*) Clear out deposits; (*e*) Replace all worn leathers.

(2) (*a*) See that compressor of adequate size is fixed initially; (*b*) See (1e); (*c*) See (1d); (*d*) Have an adequate gas supply to compressor.

(3) (*a*) See (1a); (*b*) Scrape and grease leathers; (*c*) Adjust water control valve.

(4) (*a*) Compressor too small; (*b*) Leathers may want renewing.

(5) (*a*) Leathers at auxiliary valve may want renewing; (*b*) See (3b).

(*To be Continued.*)

North British Association of Gas Managers.—The forty-ninth annual general meeting of the Association will be held at Dunfermline on the 28th and 29th inst. The business will be transacted in the Council Chambers, under the presidency of Mr. Alexander Waddell, the Engineer and Manager to the Gas Commissioners of the town, the Provost and Magistrates of which will give the members a cordial welcome. In addition to the usual routine business on the first day, the President will deliver his Inaugural Address, and there will be two papers—one on "Gaseous Fuel and the Duty of Gas Supply Authorities to the Public," by Mr. J. W. Napier, of Alloa; and the other on "The Checking of Working Costs in Small Gas-Works," by Mr. James Dickson, of Forfar. At an interval during the meeting, luncheon, to which ladies are invited, will be provided by the Town Council in an adjoining room. In the afternoon, the Carnegie Dunfermline Trust will entertain the members and their lady friends at tea in the Glen, after which the Pittencrieff Museum, Aviary, and Garden may be inspected. Dunfermline Abbey (the burial-place of King Robert the Bruce), which is adjacent, is also open to visitors. In the evening, the annual dinner will take place in the City Hotel. Next day the famous Carnegie Baths and Gymnasium will be free for inspection by members and their lady friends; and arrangements have been made for an excursion in brakes to Kinross, going round Loch Leven.

Long Cast-Iron Water-Pipe.—A new cast-iron pipe-line about 19 miles long has recently been laid between Skaneateles Lake and the Woodland reservoir, the impounding and distributing reservoirs respectively of the water-works of Syracuse (N.Y.). According to some particulars in "Engineering Record," the new line is 30 inches diameter for most of its length, and parallels an existing 30-inch pipe-line which was completed in 1894, and has been carrying practically all the city's water since that date. The population was then about 100,000, and the supply carried by the conduit amounted to about 13,600,000 gallons per day. But it has since increased to about 134,000, not including some 10,000 residents in the suburbs, most of which, it is thought, will be annexed before many years. The present water consumption of about 15 million gallons per day is in excess of the carrying capacity of the old conduit, so that it was necessary to supplement its flow by building the additional line. The combined capacity of the two conduits, when the new one is discharging into the stand-pipe near the distribution reservoir, is about 23 million gallons daily. But provision is made for turning the flow, when the stand-pipe is full, into the existing distribution reservoir; and under these conditions the combined daily capacity of the two pipe-lines will be about 28 million gallons. On the basis of the forecasts made by the Bureau of Water, the present works will serve the city until about 1931.

PROMOTION OF THE SALE OF GAS.

Reference was made in our special representative's review of the proceedings at the recent meeting of the German Association of Gas and Water Engineers at Königsberg to an account given by Herr Lempelius, of Berlin, of the new German Central Organization for Promulgating the Sale of Gas. The text of the paper from which that account was given by him has been published in the "Journal für Gasbeleuchtung;" and a fuller abstract of its contents than it was possible to furnish in the review of the proceedings at the meeting is now given.

The title of the paper as published is "The Question of the Central Organization for Promulgating the Sale of Gas, Considered Mainly from the Standpoint of the Advances and Attainments of the Gas Industry," by Herr K. Lempelius, Manager of the Central Organization. The question before gas engineers at the present time is, he says, What is the present real position of the gas industry? Is it on the down-grade, or is it at the moment standing still, or is it now experiencing one of the advances in prosperity which it has constantly experienced in the past? Electricians would reply that it was on the down-grade. They would advise the gas industry to adopt this view, and to restrict its activities to the supply of heat for industrial purposes and for heating and cooking in households. Many electricians would go even farther, and prohibit the use of gas for cooking. People of the highest position and persons who have done the greatest service in the industrial development of Germany have recommended such limitation; and weight is being given to their utterances. A brilliantly written article in the daily Press by Herr Rathenau, the Manager of the General Electricity Company, naturally took this line. The same view, however, has been expressed to the author by one of the leading Westphalian coal magnates. He said frankly that, in his opinion, the function of gas was to do away with the transport of coal through the streets, and to carry the heat required in houses through mains, while lighting would in the future be reserved for electricity. This speaker, whose interests are not inimicable to the gas industry, and whose judgment carries great weight, therefore speaks in favour of a limitation of the scope of the use of gas, while opening up a prospect of most extensive activity for it in the transport of heat and the displacement of coal as a fuel, with the consequent abolition of the nuisance of smoke and soot.

Some gas men, on the other hand, will take the view that gas is at present standing still because in the places where they work the consumption of gas has recently not advanced. Such places are, however, in a small minority; and towns in which, without some special reason, the consumption of gas has receded, are almost unknown. If we wish to answer the question ourselves in the sense of stating unhesitatingly that the gas industry is now, as in the past, experiencing constant development, we ought to be able first of all to answer a subsidiary question. We shall best gain a clear impression on the present position and prospects of the utilization of gas if we ascertain whether the appliances for the employment of gas are as technically perfect as possible for their respective purposes, and whether technical advances have been achieved with them. The establishment of this proposition is a preliminary condition of progress in the use of gas. It must be ascertained that the technical advances in the application of gas present new advantages to fresh circles of users. In regard to this question, an article published by the "Elektrotechnischen Zeitschrift" of June 16 last comes very appositely. It reports the displacement in the City of Westminster, in London, of electric street lighting by high-pressure gas. After mentioning that the district referred to includes the busiest and finest streets in London, and that the greater part of the street lighting therein has been allotted for the next five years to the Gaslight and Coke Company, the article states that the decision has attracted much attention, and is calculated to stimulate the competition between gas and electricity. As a consequence, the electricity works will be again thoroughly roused, and this cannot be in any way harmful to them. The agitation, however, in electrical circles, is more specially pronounced because the former very satisfactory lighting of the aforesaid important thoroughfares is to be displaced by high-pressure gas-lamps. The figures quoted by the gas and electrical undertakings for the lighting of the streets for the next five and ten years are then stated; and the article goes on to sound a note of alarm for electricians, who, it says, must concentrate their powers to resist the advances of gas, which is being advertised with extraordinary skill.

The foregoing statement will sound to many like advice from another world. Is it a fact that electricity cannot hold its own against the advance of gas? The news does not come, however, from another world, but from a neighbouring country with which Germany is most intimately correlated industrially. It is true for German conditions also that electricity must be on its guard against high-pressure gas lighting. The use of gas in this manner has come to England, like much else, from Germany. The far-seeing management of the municipal gas-works at Berlin has for years past been securing its increased adoption there on account of the excellent experiences gained with it. At the present time, the number of high-pressure street lamps in Berlin is many times that of the number of electric arc lamps. It is eminently desirable that this great achievement of the gas industry should be given the widest possible publicity. It will be found that persons who are, generally speaking, extremely well informed on other matters, are in complete ignorance of the fact that the brilliant lighting of many of the finest thoroughfares in Berlin is not electric. According to the author's observations, not one in a thousand of the inhabitants in Berlin is correctly informed in regard to it; and in the Provinces the proportion is even lower. Among gas men, also, many are in no way fully acquainted with the extraordinary results now being obtained by the high-pressure gas lighting in the streets of Berlin.

The article in the "Elektrotechnischen Zeitschrift" proceeded to say that the Westminster City Council had taken a retrograde step, as electric lighting was really more advantageous because, forsooth, a 3000-candle power high-pressure gas-lamp had not so far been achieved for practical use. A single nominal 3000-candle gas-lamp installed in London had, according to repeated measurements, not shown more than 2500 Hefners; whereas the 3000-candle power flame-arc lamps showed about 3500 Hefners. On this point, the Central Organization for Promulgating the Sale of Gas addressed a letter to the "Elektrotechnischen Zeitschrift," with a view to correcting the error in this statement quickly, and before it could injure the gas industry. The letter pointed out that the implication that 3000-candle power high-pressure gas-lamps were in practice under 3000-candle power, because gas-lamps of this power had not yet been achieved for practical use, was unfounded, since there were in Berlin alone 345 high-pressure gas-lamps of 4000-candle power employed for public lighting, many of them having been in continuous use for several years. The illuminating power of these lamps had been constantly checked by Professor Drehschmidt; and they were employed for lighting the principal streets in that city. The continuously increasing use of these high-pressure gas-lamps for street lighting in Berlin indicated the complete satisfaction of the municipal authorities with them; and there was only one opinion on the part of the public with regard to their brilliant effect.

High-pressure gas lighting has, the author argues, extended and advanced somewhat tardily and cautiously, as becomes good solid German methods, as opposed to those which at times are displayed in American practice. The progress made with high-pressure gas lighting seems to him to be typical of the German national character; but the system has now passed beyond Germany, and is becoming extensively employed abroad.

The question whether gas has attained to new technical uses which constitute an advance on its former employment, may be answered by reference to what has been done in the direction of high-pressure lighting, which is a brilliant advance in every sense of the word. It may be said that each high-pressure gas-lamp embodies a portion of the light of the sun, whereas each electric arc lamp embodies a portion of the light of the moon. Wherever the brilliant "sunlight" of high-pressure gas lighting comes side by side with electric arc lighting, as in Berlin, the latter has to be improved and intensified by the adoption of a more suitable type of arc lamp, or, more probably, it has to be replaced by gas, as in the case of Westminster. No further extension of electric arc lighting in the streets of Berlin is either desired or contemplated there. Even a professor at an electro-technical college has expressed the opinion to the author that electricity is not comparable with high-pressure gas for street lighting. Gas now provides a light of practically the same power as the electric arc lamp, but with the advantage of a warmer tone. The opinions, therefore, of the prominent persons already referred to—to the effect that lighting should be left exclusively to electricity—cannot be regarded as of any significance in respect of street lighting, in view of the present position and the experiences which have been reported from Berlin and London.

The gas industry, however, is not content with this result. In high-pressure lighting, so much air is drawn into the bunsen burners by the high pressure of the gas that no secondary air supply is required, and there is no cooling of the mantle by secondary air. The great economy of the high-pressure burner, which gives a duty of 55 candles and over per cubic foot of gas consumed, is now being aimed at in low-pressure gas-burners, by avoiding the cooling of the mantle due to the inflow of cool secondary air. In the more recent types of low-pressure burner, the heat of the products of combustion is utilized for warming the mixture of gas and air which is burnt; and the advance thus secured is producing results almost comparable in value with those due to the introduction of the Welsbach mantle. The low-pressure gas-burner has been so improved that lamps of 1000-candle power are on the market, in which the duty attained is about 47 candles per cubic foot, while lamps of lower candle power show only a slightly lower duty. These lamps are therefore economically almost equal to the large high-pressure gas-lamps. That finality has been reached in the development of gas-burners in the direction of economy in the conversion of the gas into light cannot be contended. The progress in economy has continued up to the most recent time. There has never been a period of more vigorous and continuous progress in the perfecting of gas-lamps than the present. The output of burners from the leading factories is also phenomenal.

The question of whether a continuous development in the use of gas is taking place must, therefore, be answered with an emphatic affirmative. Gas engineers of the present day may well rejoice that it has been their lot to live in times when these new industrial results are being achieved. The advantages of gas as a competitor for the supply of heat have been well proclaimed in

Germany. The article in the "Elektrotechnischen Zeitschrift" already referred to speaks of the activity displayed by a few firms in publishing broadcast through the agency of the whole of the gas industry pamphlets promulgating the advantages of gas. It is not clear what is meant by this statement; but gas engineers will first call to mind the name of Herr Schäfer, the Chief Engineer of the German Continental Gas Company of Dessau, who has many times been regarded as a great mischief-maker by electricians. Lately, in a very valuable paper, which the Central Organization has distributed, he has set forth for gas men the more recent applications of gas in art and industry. Another valuable paper in the same direction is that of Dr. Schilling. [An abstract translation of this has recently been given in the "JOURNAL," *ante*, p. 35.]

These communications show that it is the business of the gas manager to further the introduction of apparatus for the use of gas wherever the conditions are favourable; and in regard to Germany, it may be said that the cases in which there are not favourable conditions for the use of gas for heating and lighting are quite exceptional. In particular, the less well-to-do sections of the population should be invited to participate in the advance in civilization which the extended use of gas implies, just as much as they have established their right to the use of soap. This may be done by the introduction of prepayment meters and the provision of services and cooking apparatus free of charge. These sections of the population have no capital which they can apply in this way themselves; and even if they had the capital, they would not install the appliances in rooms which they rent only for short periods. To these classes, gas appeals particularly as a source of heat for cooking, because of the economy it effects in time, labour, and effort, thereby permitting the housewife to give greater attention to her children and other household duties. There is no doubt that, as indicated by the Rhenish Westphalian coal magnate already quoted, the coal traffic must eventually disappear from the streets, and the damage done by smoke from coal-fires vanish from the houses. But petroleum oil also—with its smoke and danger and the outflow of money abroad which its purchase involves—must disappear from the dwellings of the poorer classes, just as it has from those of the well-to-do. They have now a cheaper light in the modern types of inverted incandescent gas-lamps, which entail an outlay of little more than one-twentieth of a penny per hour for a light of 50 candles.

If we consider the grounds which are the bases of the extraordinary economical capacity of the gas industry to resist competition, we may, with advantage, refer to a further statement of Geheimrat Rathenau, who points out that, since coal cannot be won and transported below a certain cost, other ways must be looked for in order to produce electricity cheaply. The problem is not new; for gas-works would not be able to sell gas at present prices if it were not that valuable products are withdrawn from the coal in addition to the gas. Unfortunately, it has not yet been found possible to obtain similar valuable products from coal when it is burnt under the boilers or in other furnaces in electricity and other works. If the cost of fuel in such plant could be either wholly, or to a large extent, covered by the value of the bye-products obtained from it, the industrial and business life of the country would be revolutionized, and people would be enabled to let electricity play the prominent part which he thinks it should play in modern civilization.

Geheimrat Rathenau is quite right in that he shows that the gas industry has solved the problem of obtaining from the coal more valuable products than are obtainable in any other method of applying coal for heating purposes. We may appropriately take Geheimrat Rathenau's own words in respect of electricity, and apply them by merely substituting the word gas for electricity. "Manufacturing stations must be established in considerable numbers which will supply 'gas' to consumers at extremely low prices when consumption and production are regulated in a proper manner. Theoretically, this problem presents no insuperable difficulties. Without entering into details of this method of 'gas' supply, it is enough to point out that a distributing system throughout the country serves as a reservoir into which 'gas' is pumped, according to the requirements of the consumer, from suitably distributed manufacturing stations." In this manner, the town of Lübeck has already undertaken the supply of gas as far as Travemünde, and the City of Berlin the supply to suburbs at considerable distances. Barmen is about to obtain its gas from the Ruhr coal-fields over 30 miles away. The industrial conditions are clearly favourable at the present time for the spread of the use of gas. The question whether we are now in a period of expansion in the gas industry, not alone in respect of technical construction, must be answered with an emphatic "Yes." In regard to this commercial part of the business of gas supply, the leaders of the industry have struck out on lines which were foreign to their predecessors; and the results are very promising. The gas industry has now for the first time to unite against competing and opposing interests, in order to further the cause of the extension of the use of gas. Municipal undertakings as well as gas companies have supported this object in an extensive measure. It should be impressed upon them, however, that the Central Organization for Promulgating the Sale of Gas should be given by them the necessary moral and financial support. It is the object of this organization to impart to all and sundry a knowledge of what can be done for them by the gas industry, and to do this by means of explanations addressed to the public, the press, and authorities, and by means of trade exhibitions. It will endeavour to combine the hitherto disjointed efforts of individuals in the same direction, in order to give their various efforts a wider application.

The author goes on to speak of the success which has attended the lectures given in various places by Fräulein Wirth, who is one of the lady lecturers engaged by the German Continental Gas Company, and lent by them from time to time to other gas undertakings. The author proposes to extend this class of work. The Central Organization will also communicate to its members information of which they may stand in need for extending the employment of gas; and for this information it will rely largely on the experiences gained by other members, who will be asked to support the general cause by communicating the results of their experiences to the Organization, or to the Technical Press. The author proceeds to say that much must not be expected from his personal ability, and that the Organization must largely depend on the continued efforts of Herr Schäfer and others, who have in the past done so much to assist in bringing to the knowledge of the public the advantages and manifold uses of gas. As a result of the propaganda of the organization and its supporters, it may, the author says, be hoped that German people will be roused to apply to gas engineers to supply them with gas on such a scale that they will be able to say that Germany, which in other respects holds a premier position among civilized countries, will be justified in claiming a similar honourable position in respect of the result of the application to it of the test of the degree of civilization which is afforded by the extent of the consumption of gas.

LIGHT DISTRIBUTION IN VARIOUS DIRECTIONS

In the course of a paper on "Some Methods of Measuring Light," read by Mr. W. C. Philpott, of Toronto, at the annual meeting of the Canadian Gas Association, he made the following remarks on the subject of the distribution of light in different directions.

It is necessary to remember, when comparing lamps, that some send more light downwards than upwards, and others more upward than downwards; and that the true value of a lamp depends on its shedding its light in the direction where it is most required. For lighting factories, public buildings, and large inside areas, it is necessary to throw the light sideways and downwards. For street lighting, a lamp is desired to send the greater parts of its light sideways, and not in a centralized area under the lamp alone. When comparing the efficiencies of various lamps, it is necessary to calculate their candle power on a common basis. To bring about this comparison, the candle power of various lamps is usually expressed as the "mean spherical candle power," or "mean hemispherical candle power"—expressions which may be explained by imagining a light enclosed in a sphere or hemisphere set at a radius of 1 foot from the source of the light.

In any fair comparison of different lights, it is necessary to consider not only the light that is sent out horizontally, but the total light that is shed in all directions which is proportional to the mean spherical candle power. It must, however, be borne in mind that the light rays thrown upwards are in some cases useless; and in these cases the true efficiency of the lamp should be calculated on the mean hemispherical basis. The rays of light which would under some circumstances be useless when thrown upwards, can, with a judicious arrangement of reflectors, be made to fall downwards or sideways, and become a valuable lighting factor. To measure the light thrown in different directions and at different angles, the flicker disc-box is most suitable.

The inequality of the distribution of light from different lamps will be better understood by referring to the following figures:—

Upright Welsbach Burner without Shade.

Direction of Rays.	Candle Power.
Straight up	20
67½° above horizontal	32
45° " "	50
22½° " "	75
Horizontal	63
22½° below horizontal	40
45° " "	22
67½° " "	15
Straight down	0

Mean spherical candle power, 47·75

Upright Welsbach Burner with Reflector.

Direction of Rays.	Candle Power.
Horizontal	58
22½° below horizontal	75
45° " "	65
67½° " "	27
90° " "	0

Mean hemispherical candle power, 60·29

Inverted Burner with Clear Globe and Reflector.

Direction of Rays.	Candle Power.
Horizontal	40
15° below horizontal	43
30° " "	43
45° " "	48
60° " "	40
75° " "	42

Mean hemispherical candle power, 43·046

Humphrey Lamp with Four Burners, Clear Globe with Reflector.

Direction of Rays.	Candle Power.
Horizontal	410
15° below horizontal	330
30° " "	350
45° " "	355
60° " "	188
75° " "	185
90° " "	150

Mean hemispherical candle power, 320·28

The foregoing tests were made with gas having a net calorific value of about 600 B.Th.U. at a pressure of 2·5 inches head of water.

By comparing the first two tables, the effect of using reflectors will be noticed. The light rays from all lamps are, in the majority of cases, thrown in an upward direction, where, in the greater number of cases, it is less needful. The upward light can be intercepted and reflected in the direction where most required. The type of reflectors and globes used has all to do with good effective lighting; and a few hours spent in choosing suitable materials for the particular kind of lighting to be done would amply repay anyone having to do with inside or outside illumination. Surrounding circumstances must also be given due consideration. The problems of absorption and emission of surfaces on which the light falls must be reckoned with; and each particular case should be considered by itself.

REGULATING THE AIR SUPPLY TO GENERATORS.

Bromham's Patent.

It is a matter of common experience that, in ordinary working, when the grate of the generator has recently been cleaned, the primary air enters the furnace in larger quantity than when the grate is obstructed. This extra inflow of primary air passing into the layer of coke forms an excess of carbonic oxide, which, combined with the secondary air, causes imperfect combustion at the outlet of the furnace, and consequently loss of fuel. When the generator is at work, the coke in process of consumption produces ash and clinker, which gradually clog the grate; and if this continues the passages for the primary air will become so reduced in size that the supply of air will be inadequate, with the result that the quantity of carbonic oxide will gradually diminish. The secondary air will then pass into the chimney gases, and cooling of the furnace will follow. This, however, can be obviated by properly regulating the admission of primary air to the furnace; and M. Bromham, one of the Engineers at the Brussels Municipal Gas-Works, has designed and patented an appliance by which he says this object may be effectually accomplished. As mentioned in the account of these works given in the "JOURNAL" last week, M. Bromham's regulator is in use in connection with a large installation of inclined conical retorts; and he explained its working to the members of the Société Technique on the occasion of their recent visit. It is shown in the accompanying illustrations—fig. 1 being a longitudinal section of a furnace fitted with it (taken on the line CD of fig. 2), while fig. 2 is partly an elevation and partly a section on the line AB of fig. 1.

Referring to fig. 2, it will be noticed that a strong clock A, hung in the basement of the retort-house, actuates a light transmission-rod B running from one end of the bench to the other.

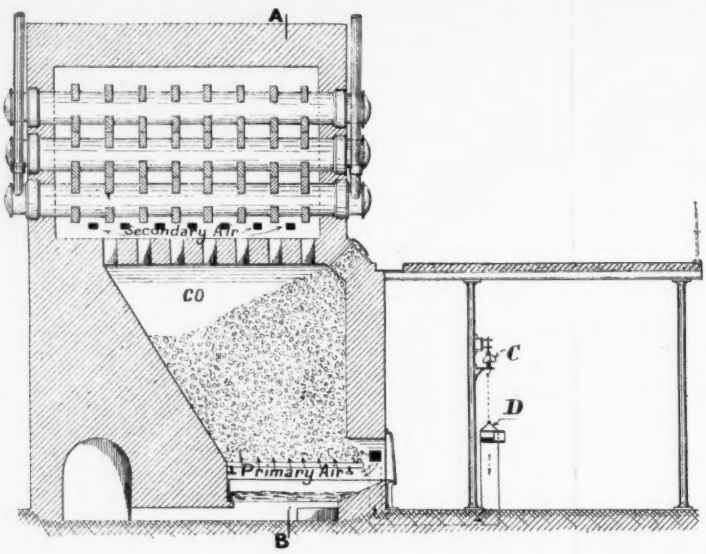


Fig. 1.

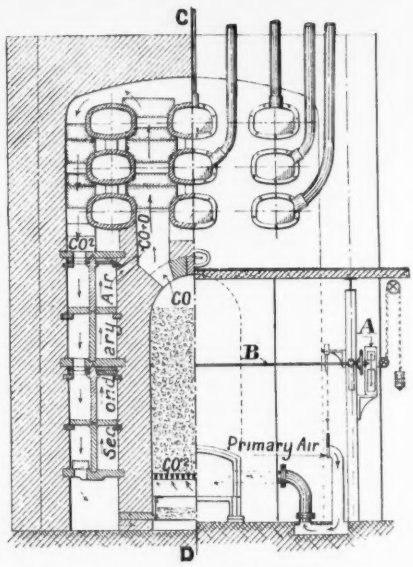


Fig. 2.

Bromham's Regulator of the Primary Air Supply to Generators.

To this rod is attached a cam C (fig. 1), which makes one revolution in the time elapsing between two clinkerings. This cam causes the slide of the primary air valve D to rise. When the grate is cleared, the opening of the slide is at its minimum; and consequent upon the rotation of the rod B, the cam entrains gradually the valve D, which opens slowly and regularly. The form of the cam is such that when the time for the clinkering of a furnace arrives, the valve, having reached the extent of its travel, closes automatically, and starts working again without requiring any attention. As soon as the valve is closed, the stoker can commence clearing the hearth. When he has finished, he closes the doors, and the regulation is perfect during a fresh cycle. The speed at which the rod B revolves may be regulated as desired by simply shifting an index pinion. No regulator will then close except at the hour for which it has been set.

The gradual opening of the inlet for primary air corresponds with the rate of obstruction of the grate by ash and clinker. The result is that the volume of primary air admitted to the furnace is always constant; the effect being to produce a regular quantity of carbonic oxide in the generator, and ensure unvarying composition of the escaping gases. Some analyses of these gases from one of the settings at the Brussels Gas-Works testify to the efficiency of M. Bromham's regulator. The gases were taken at the point where the letters CO_2 occur on the left-hand side of fig. 2. With the ordinary arrangement, the quantity of carbonic oxide dropped from 2·6 per cent. to zero in a period of 8½ hours from the time of clinkering. After this the furnace began to cool, the presence of oxygen manifested itself, and gradually increased in quantity till it reached 2·6 per cent. at the end of 14 hours, when clinkering again became necessary. When, however, the regulator was employed, there was no loss of fuel and no cooling of the furnace; the carbonic oxide and oxygen varying only from zero to 0·2 per cent.—to be regarded as perfect regulation.

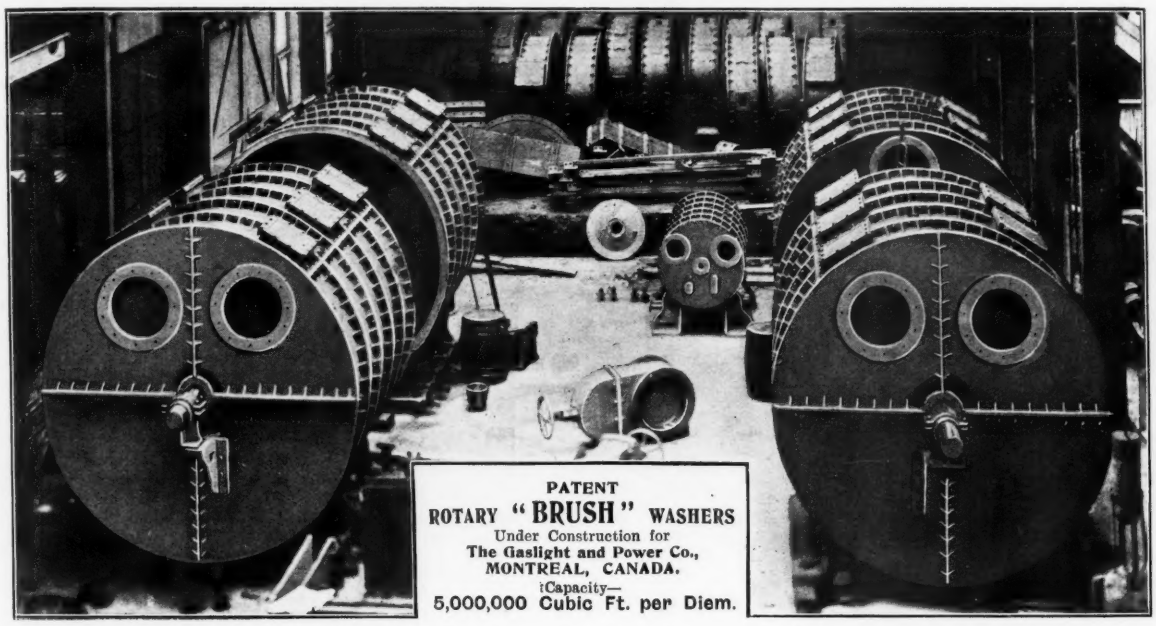
The advantages claimed for the appliance are that by its use economy of fuel is effected, there is a regular temperature during the entire period between two clinkerings, no excessive heating takes place after these operations, and consequently there is less wear and tear of the refractory material, and greater regularity in the production of gas. The cost of upkeep is practically *nil*, as the installation needs only a little oil once a week; and a special workman is not required to look after it.

In the "JOURNAL" for the 28th ult., it was recorded that, in view of his approaching marriage, Mr. Harley Andrew Stephenson, son of the late Mr. Andrew Stephenson, had been the recipient of a present from the London officials of the British Gaslight Company. His friends will be pleased to learn that his wedding with Miss Stella Hetherington took place on the 9th inst.

We are sorry to learn that Doris Bullivant, the daughter of the Secretary of the Derby Gas Company, has died in Derby Infirmary from injuries sustained at some athletic sports at Derby last Saturday. During a motor-cycle race, one of the machines got out of control and dashed into the crowd. The girl, who was eleven years of age, was knocked down, rendered unconscious, and never recovered.

W. C. HOLMES & Co. LTD.,

Whitestone Ironworks, HUDDERSFIELD. London Office: 11, Victoria Street, S.W.



PATENT
ROTARY "BRUSH" WASHERS
Under Construction for
The Gaslight and Power Co.,
MONTREAL, CANADA.
Capacity—
5,000,000 Cubic Ft. per Diem.

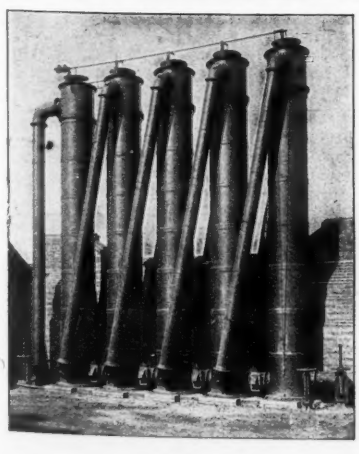
Repeat Orders for Machines of the Type shewn above Recently Received from:

THE ORIENTAL GAS COMPANY, CALCUTTA;
THE IMPERIAL CONTINENTAL GAS ASSOCIATION, BRUSSELS
WALLASEY, U.D.C.; LUTON GAS COMPANY, &c, &c.

Gas Engineers of the most important Works are high in their praises of the Fire-Clay Goods supplied by

MOBBERLEY & PERRY OF STOURBRIDGE.
LIMITED,

GAS-RETORTS A SPECIALITÉ.



GASHOLDERS.
WITH GUIDE FRAMING OR COLUMNLESS.

LUTED PURIFIERS LUTELESS

WATER **Condensers** AIR

GAS PLANT OF EVERY DESCRIPTION
DESIGNED AND ERECTED.

C. & W. WALKER, LTD., MIDLAND IRON WORKS, DONNINGTON, SALOP. 110, CANNON STREET, LONDON, E.C.

CONTINUOUS CARBONIZATION

IN

VERTICAL RETORTS

* *

GLOVER-WEST PATENTS.

Description and Particulars of Tests will be forwarded on request.

* *

COST OF LABOUR

REDUCED TO

2¾d. PER TON OF COAL CARBONIZED.

See "JOURNAL OF GAS LIGHTING," Nov. 2, 1909.

WEST'S GAS IMPROVEMENT CO., LTD.,

Engineers,

104, QUEEN VICTORIA STREET,
LONDON, E.C.

Telegrams—"STOKER, MANCHESTER."
"RADIARY, LONDON."
Telephones—Nos. 1339 and 5520 Manchester (Central).
No. 14,406 London (Central).

MILES PLATTING, MANCHESTER.

FURTHER STUDIES IN COAL CARBONIZATION.

When noticing a fortnight since the Forty-Sixth Annual Report of the Chief Inspector under the Alkali Works Regulation Act, 1906 (which was signed by Mr. R. Forbes Carpenter, with an expression of regret that continued ill-health precluded his doing more than generally supervise its preparation, the work in connection with which was carried out by his Assistant, Mr. S. E. Linder, B.Sc.), some allusion was made to the further studies in coal carbonization which had been carried out during the year under review. The statement with regard to this work constitutes an important and considerable part of the report; and in view of its particular interest to readers of the "Journal," we now reproduce it in full.

Interaction of Methane and Ammonia in Presence of Carbon.

Introductory.

At the conclusion of the experimental work described in the forty-fifth report, 1908, it was seen that continuance of the work on the lines laid down in that research would be impossible, accompanied, as each experiment had to be, by gas analysis of a laborious character. During the present year, however, it was felt that some effort should be made to continue the research, when opportunity offered, on a less ambitious scale, with a view, if possible, of clearing up some of the many problems left unsolved at the conclusion of the work in 1908—more especially those relating to the yield of hydrocyanic acid at different temperatures and varying rates of flow. It seemed desirable to confine attention entirely to the reactions taking place in presence of wood charcoal and graphitic carbon, and to exclude porcelain altogether from consideration, as the results obtained in 1908 clearly proved that, at temperatures exceeding 800° C., porcelain has a strong oxidizing effect on hydrocarbons, ammonia, and hydrocyanic acid.

On endeavouring to repeat some of the results obtained in 1908 with wood charcoal, it was found that the charcoal could not always be relied upon to yield the same results under the same conditions of temperature, rate of flow, and volume and composition of reacting mixture—in fact, that the efficiency of the contact material itself was subject to variation. The cause of this variation is obscure; but there is reason to connect it with the fact that hydrocarbons and hydrocyanic acid are more or less unstable in contact with carbon at high temperatures. Under such conditions, carbon of possibly graphitic character is deposited on the surface and within the pores of the contact material, and profoundly modifies its character. It was further found that, after continued treatment with coal gas (freed from illuminants) and ammonia, the wood charcoal became uniformly coated throughout its substance, and that the catalytic power attained a value sufficiently constant to justify the use of the material for the purpose of determining the comparative effect of varying temperature and other factors under controlled conditions.

The wood charcoal was prepared for use in the comparative experiments by continuing the treatment with ammonia and coal gas,* under the same conditions, until approximately constant results were obtained. The temperature or rate of flow was then altered, and a series of results obtained. Conditions were finally restored, and the original experiment repeated. Agreement between the first and last experiments was considered to be proof that the contact material remained unchanged throughout the series. Thus, at 915° C., the following results were obtained:—

	Per 100 parts of NH_3 entering.		
	Undecomposed.	AsHCy.	Decomposed.
Eighth experiment on Wood Charcoal A. .	86·3 ..	6·0 ..	7·7
Thirty-first experiment on Wood Charcoal A	86·9 ..	5·7 ..	7·4

Twenty-two experiments at various temperatures and rates of flow intervened between these two, including ten experiments with hydrogen as diluent.

Fifty-six experiments in all were made with "Wood Charcoal A," including blank experiments with diluent coal gas and hydrogen alone. In the series: Experiments I. to XIV. were made with ammonia and diluent coal gas. Experiments XV. to XXIV. were made with ammonia and diluent hydrogen. Experiments XXV. to XLI. were made with ammonia and diluent coal gas. Experiments XLII. to XLVI. were made with hydrocyanic acid and coal gas. Experiments XLVII. and XLVIII. were made with ammonia and coal gas. Experiments XLIX. and L. were made with ammonia and hydrogen. Experiments LI. and LII. were made with ammonia and coal gas. Experiments LIII. and LIV. (air treatment to restore activity). Experiments LV. and LVI. were made with ammonia and coal gas. Ten experiments were made with "Wood Charcoal B," taken from the same sample as "A." In this series: Experiments I. to III., V., and VII. were made with ammonia and diluent coal gas. Experiments IV. and VI. were made with ammonia and diluent hydrogen. Experiments VIII. and IX. were made with ammonia and coal gas *plus* ethylene. Experiment X. was made with ammonia and coal gas.

In Tables I. to IV. below, the results are numbered consecutively (Nos. 1 to 31), and without reference to the order in which the experiments were made. In many cases, figures are averaged, and presented as one result. Before proceeding to discuss the results in detail, it will be convenient to summarize here the more important conclusions arrived at.

1.—That the efficiency of wood charcoal in effecting the conversion of ammonia into hydrocyanic acid decreases with use. Such decrease is attributed to the deposition on the surface of the charcoal of graphitic or other form of carbon derived from hydrocarbons or hydrocyanic acid as a result of thermal decomposition.

2.—That the hydrocyanic acid so obtained is the product of a reversible reaction controlled by temperature and accompanied by secondary reactions yielding carbon, nitrogen, and hydrogen, by thermal decomposition of NH_3 and HCy. Thus—

$$NH_3 + C \rightleftharpoons HCN + H_2$$
$$2NH_3 = N_2 + 3H_2$$
$$2HCN = H_2 + 2C + N_2 \qquad \text{(Table I.)}$$

3.—That in presence of wood charcoal coated with graphitic carbon, hydrocyanic acid possesses a high degree of stability up to a temperature of 1000° C. At 1100° C., thermal decomposition begins to be rapid. (Fig. 3.)

4.—That the presence of hydrocarbons, methane and especially ethylene, is favourable, but not essential, to a high yield of hydrocyanic acid; ammonia acting directly on carbon to form hydrocyanic acid in presence of hydrogen alone as diluent. (Tables III. and VI.)

As the present work was approaching completion, attention was directed to the researches of Dr. G. A. Voerkelius on the "Formation of Hydrocyanic Acid from Ammonia and Wood Charcoal," published in the "Chemiker Zeitung," 1909, 33, 1025-1026, 1078-1081, 1090-1092. Dr. Voerkelius, by independent research, and employing other apparatus and procedure, has arrived at conclusions very similar to those stated above; and the two researches afford mutual support and confirmation.

Apparatus and Procedure.

The procedure was substantially that adopted in 1908 and detailed in the forty-fifth report. Briefly stated, two controlled streams of diluent gas and ammonia (or hydrocyanic acid) were delivered to a mixing flask, and thence to a furnace tube of silica, packed with fragments of contact material and heated to the desired temperature by means of a ten-burner Méker furnace. The exit gases were passed successively through one or more Drechsel's bottles containing standard sulphuric acid to absorb ammonia, and through caustic soda to absorb hydrocyanic acid, before entering the water-aspirator in which they were stored and measured. A layer of oil was placed on the surface of the water in the aspirator to minimize absorption of the gases. The apparatus formerly employed was modified in certain important details, with a view to secure greater regularity in the flow of the reacting mixture through the system. This was effected by placing the bolt-head flask (in which the purified coal gas was stored) in connection with a cistern adjustable at any desired height, and provided with a constant flow of water. By this means, the pressure of gas in the bolt-head could be maintained throughout an experiment within extremely narrow limits, and the attention of the operator released for other and more important duties. The diluent coal gas, hydrogen, or enriched coal gas, as the case might be, was dried before entering the flask in which admixture took place with ammonia (delivered from the mercury cylinder) by passage through a scrubber containing pumice moistened with strong sulphuric acid; a mercury seal being interposed between the scrubber and mixing flask to obviate risk of absorption of ammonia by the acid, should the gaseous current receive a check.

Pyrometer readings were taken at intervals of a few minutes throughout the experiment, and the results averaged. The temperature range in general did not exceed 10° C. in any one experiment.

A trial run was made in every experiment to determine the weights of ammonia and hydrocyanic acid obtained when the diluent gas alone was passed through the heated tube. This was conveniently effected by providing the exit end of the tube with a bye-pass arrangement delivering both to the air and to a secondary system of absorbing bottles containing standard acid and caustic soda. During the period of heating-up, the exit gases were drawn into a small aspirator. As soon as constant temperature conditions were attained, they were diverted through the secondary train of absorbers; the volume of diluent gas used being then recorded. At the conclusion of the blank experiment, the bye-pass connection was closed, and communication was opened with the primary train of Drechsel's bottles. The production of traces of hydrocyanic acid and ammonia was noticed in nearly all the blank experiments. It is attributed, in part, to the direct interaction of nitrogen and hydrogen in the reacting mixture. The amounts of such hydrocyanic acid and ammonia obtained, and

* "Coal gas" throughout these remarks denotes the purified product deprived of its illuminants in the manner described in the forty-fifth report for 1908. See "Journal," Vol. CVII., pp. 569, 570.

the relative proportions of these bodies, varied both with the condition of the contact material and with the temperature; the united figure for the two products attaining a maximum with uncoated wood charcoal at 1000° C. No correction was possible for hydrocyanic acid and ammonia introduced in this way. The figures presented in the tables are, therefore, inclusive.

Diluent Gas.—As before, the coal gas employed as diluent was drawn from the laboratory service-pipe, and was freed from illuminants, carbon dioxide, and other impurities in the manner described in the 1908 report. It was only found possible to analyze the coal gas in two experiments (see Table III., Nos. 18, 20). Any variation in methane content would, of course, be a disturbing factor. But such variation would not be very great; and its effect was reduced by the practice of preparing a somewhat larger stock of purified gas than was required for one day's work—the balance being used on the following day, with such addition of fresh gas as might be required. Twenty-two analyses of purified coal gas in 1908 showed an average methane content of 28 per cent. (maximum 31·5; minimum, 23·7). Carbon monoxide appears to act simply as a diluent, and need not be considered.

In the experiments with ethylene, purified coal gas was enriched with ethylene generated by heating a mixture of absolute alcohol and strong sulphuric acid; the ethylene being washed with sulphuric acid and caustic soda.

Hydrogen was prepared from zinc and dilute acid. The gas was freed from arsenic and sulphuretted hydrogen by means of chromic acid and caustic soda.

Contact Material.—The wood charcoal used was taken from the stock employed for the experiments made in 1908, and was graded and prepared for use as there described. The specific gravity after use was 0·5 (approximately).

Sample A. (after 56 experiments) left, on ignition, 1·6 per cent. of ash. Fe, 0·01 per cent.

Sample B. (as charged) left, on ignition, 1·7 per cent. of ash Fe, 0·003 per cent.

In addition, a few experiments were made on two samples of retort carbon kindly forwarded by Dr. Rudolf Lessing. These are described as—

"Hard scurf from bottom of gas-retort:" Ash, 0·5 per cent.; sp. gr., 1·8.

"Granular carbon deposited from purified coal gas:" Ash, *nil*.

Analytical Results.

It has already been remarked that the efficiency of wood charcoal as a contact material for the conversion of ammonia into hydrocyanic acid shows great variation, according to the use to which it has been put. The cause of this variation appears to be related in some way to the deposition upon the surface of graphitic or other form of carbon derived from thermal decomposition of hydrocarbons, or possibly of hydrocyanic acid, or both. This hypothesis is supported by the fact that, after continued use with coal gas, the surface of the wood charcoal acquires a silvery appearance. Hydrocyanic acid, on the other hand, produces a bronzed appearance of the surface. The efficiency attained a maximum after limited treatment of the charcoal with ammonia and coal gas; on continued treatment, the efficiency fell to an approximately constant value; subsequent treatment with ammonia and hydrogen restored the activity. Hydrocyanic acid, on the other hand, had the opposite effect; marked loss of efficiency resulting when a mixture of hydrocyanic acid and coal gas was sent over the coated material at 1000° to 1100° C. Treatment with air at 1000° C. partially restored activity. Thus, wood charcoal "A" at 1000° C.

	Yield of HCy Per Cent. of NH_3 Taken.
Experiment No. IV.—Partially coated by treatment with ammonia and coal gas	31·5
,, XIII.—Completely coated by treatment with ammonia and coal gas	18·4
,, XXV.—Coat removed by treatment with ammonia and hydrogen	30·4
,, XXVIII.—Re-coated by treatment with ammonia and coal gas	16·7
,, LII.—After treatment with hydrocyanic acid and coal gas	6·9
,, LIII.—After subsequent treatment with air	11·4
,, LIV.—Further subsequent treatment with air	12·7

It is necessary to bear these facts in mind when one set of results is compared with another. Comparative figures are only of value when the condition of the contact material is accurately known. In the present research, an endeavour was made to ensure equal conditions when the effect of varying any one factor, temperature, rate of flow, &c., was under trial.

Tables and Diagrams.—For convenience of reference, the various results have been brought together in tabular form. The data presented are of the same character throughout, so it will be convenient to consider their meaning. In the headings to tables:

"Volume 230 c.c." denotes the volume of the tube heated to constant temperature and occupied by the stated weight of contact material used.

"Rate of Flow" denotes the volume in c.c. of reacting mixture (diluent gas *plus* ammonia) entering the tube per minute, measured at 0° C., 760 mm. dry, "slow" rate of flow—80 to 90 c.c. per minute (*see* the forty-fifth report) being the most rapid of those employed in the present series.

"Duration of Experiment" denotes the number of minutes occupied in the experiment, measured from the moment when the exit gases are sent through the primary train of Drechsel's bottles to the moment when the supply of inlet gas was shut off and the water aspirator stopped; and the expression "Coal gas entering" denotes the volume of the purified diluent gas entering the tube during such period.

"Reacting mixture" denotes the mixed diluent gas and ammonia entering the tube; and the expression "Time in tube" the estimated time taken by such mixture to pass through the heated free space in the tube. It is calculated as follows:—

Total space, 230 c.c.; deduct volume of wood charcoal $\left(\frac{55}{\cdot 5}\right)$ = 110 c.c.

whence, free space = 120 c.c.

Let duration of experiment be t minutes.

Let total volume of reacting mixture be x c.c.

Then, time in tube = $\frac{t \times 120 \times 60}{x}$ seconds.

Calculated Increase Volume of Exit Gases due to Dissociation of Hydrocarbons.—This figure is arrived at by deducting from the volume of exit gases measured in the water-aspirator the volume of exit gases calculated; due allowance being made for the products of reaction in which ammonia is concerned (all volumes measured at 0° C. 760 mm.). An example will serve to illustrate the nature of the calculations involved:—

Table I., No. 9.	860° C.
Volume of coal gas entering	3742 c.c.
Add hydrogen set free in reaction ($NH_3 + C. = HCN + H_2$) 18 c.c.	
Add hydrogen and nitrogen ($2NH_3 = N_2 + 3H_2$) 186 c.c.	
	204 c.c.
Total calculated	3946 c.c.
Total found	4000 c.c.
	+ 54 (= 55 c.c. approx.)

These gas volumes are only very approximate. Much of the work had to be done in July and August, when air temperature was high. In addition, the furnace itself was a source of heat. The results under this heading are given with considerable reserve; but they indicate, with some approximation to truth, the extent to which the contact material is active in promoting thermal decomposition of the hydrocarbons present when coal gas is used as diluent. With hydrogen, there should be no excess volume, as hydrocarbons are absent—*cf.* experiment No. 19, Table III., where the calculated excess is 1 c.c.

Analysis of Gases and Methods of Calculation.—These questions were fully discussed in the report for 1908, to which attention is directed. Additional confirmation has been obtained during the present work of the reliability of the apparatus and procedure adopted last year. In one experiment at 700° C. (Series A., XLVIII.), not included in the tables presented here, 98·9 per cent. of the ammonia entering the furnace tube was obtained at the exit in the form of hydrocyanic acid (0·9 per cent.) and undecomposed ammonia (98 per cent.); leaving only 1·1 per cent. for ammonia decomposed into its elements, and otherwise unaccounted for. In another experiment at 785° C. (Series A., No. XLVII.), 98 per cent. of ammonia entering was so recovered—2·5 being as hydrocyanic acid; leaving only 2 per cent. for decomposed. These experiments immediately succeeded those recorded in Table III., which are Nos. XLII. to XLVI., in Series A. Results were equally consistent at other temperatures.

Table I.—Influence of Temperature and Rate of Flow.

In Table I., each of the experiments referred to as Nos. 1, 3, 4, and 8 is the average of two results; No. 2 is the average of three results; the others are single experiments. The efficiency of wood charcoal throughout the series remained practically constant.

Conditions throughout were approximately constant as regards the composition and volume of the reacting mixture. The effect of varying the rate of flow and temperature is best seen in figs. 1 and 2, in which the results given in Table I. are interpreted graphically.

From fig. 1, we learn (1) That the rate of thermal decomposition of ammonia rises rapidly with temperature from 2·8 per cent. at 860° C. to 46·6 per cent. at 1100° C. (2) That the yield of hydrocyanic acid at "slow" rate of flow increases with temperature from 3·6 per cent. at 860° C. to 22·9 per cent. at 1100° C.

From fig. 2, we learn that the yield of hydrocyanic acid is practically independent of rate of flow at temperatures not exceeding 1000° C. Thus, at 1000°C: At 21 c.c. per minute, 17·9 per cent. HCy; at 40 c.c., 17·7 per cent. HCy; at 82 c.c., 17·7 per cent. HCy. At 1100° C., on the other hand, the yield rapidly increases with increase in rate of flow. Thus: At 21 c.c. per minute, 5·8 per cent. HCy; at 41 c.c., 15 per cent. HCy; at 87 c.c., 22·9 per cent. HCy.

INFLUENCE OF TEMPERATURE ON YIELD OF HCy AND DECOMPOSITION OF NH_3.

"Slow" Rate of Flow, 82 to 87 c.c. per minute.

Wood Charcoal A.

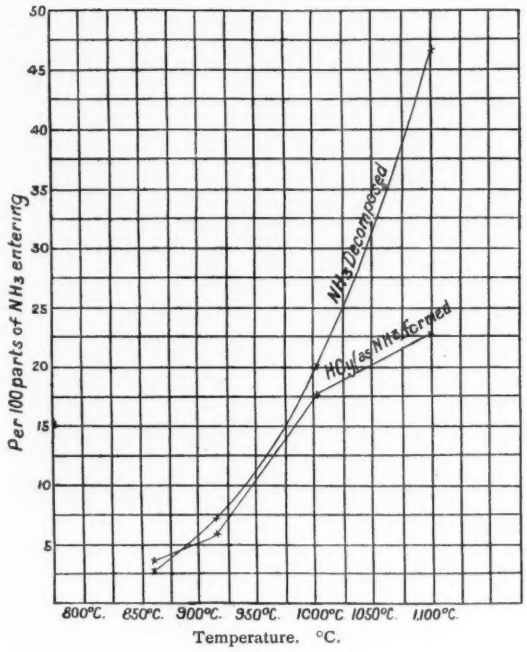


Fig. 1.

TABLE I.—*Interaction of Methane and Ammonia. Influence of Temperature and Rate of Flow.*

Rate of Flow.	Wood Charcoal (A). Volume, 230 c.c.; Weight, 55 grammes.			
	860° C.	915° C.	1030° C.	1100° C.
Experiment No.	**1.**	**2.**	**3.**	**4.**
"Slow" rate. .c.c. per min.	84	85	82	87
Reacting mixture:—				
NH_3, volume per cent. . .	10·8	10·8	10·8	11·2
Time in tube . . . secs.	85	86	87	82
Ammonia balance:—				
NH_3 entering tube, grammes	0·351	0·348	0·345	0·355
NH_3 products, per cent.:—				
Undecomposed . . .	93·6	86·9	62·3	30·5
As hydrocyanic acid . .	3·6	5·9	17·7	22 9
Decomposed (by diff.). .	2·8	7·2	20·0	46·6
	100·0	100·0	100·0	100·0
Calculated increase volume of exit gases due to dissociation of hydrocarbons . . c.c.	−40	+125	+255	+740
Experiment No.	**5.**	**6.**	**7.**	**8.**
"Slower" rate .c.c. per min.	40	45	40	41
Reacting mixture:—				
NH_3, volume per cent. . .	11·2	10·9	11·0	11·0
Time in tube . . . secs.	178	161	182	173
Ammonia balance:—				
NH_3 entering tube, grammes	0·355	0·347	0·338	0·357
NH_3, products per cent.:—				
Undecomposed . . .	84·5	77·5	52·7	24·0
As hydrocyanic acid . .	4·2	8·1	17·7	15·0
Decomposed (by diff.) .	11·3	14·4	29·6	61·0
	100·0	100·0	100·0	100·0
Calculated increase volume of exit gases due to dissociation of hydrocarbons . . c.c.	−15	+175	+420	+770
Experiment No.	**9.**	**10.**	**11.**	**12.**
"Slowest" rate .c.c. per min.	21	21	21	21
Reacting mixture:—				
NH_3, volume per cent. . .	11·2	10·6	11·3	11·1
Time in tube . . . secs.	340	337	349	343
Ammonia balance:—				
NH_3 entering tube, grammes	0·361	0·346	0·357	0·355
NH_3, products per cent.:—				
Undecomposed. . . .	76·4	64·7	42·9	13·2
As hydrocyanic acid . .	3·9	5·8	17·9	5·8
Decomposed (by diff.) .	19·7	29·5	39·2	81·0
	100·0	100·0	100·0	100·0
Calculated increase volume of exit gases due to dissociation of hydrocarbons . . c.c.	+55	—	+595	+840

Consideration of these and other results leads to the conclusion that hydrocyanic acid is the product of a reversible reaction,

INFLUENCE OF RATE OF FLOW ON YIELD OF HCy.

HCy produced per 100 parts of NH_3 entering.

Wood Charcoal A.

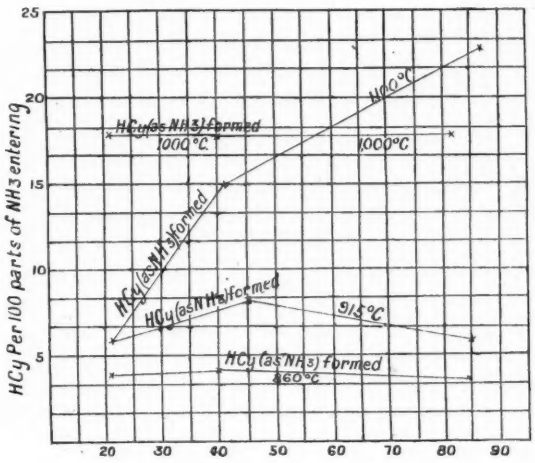

HCy Per 100 parts of NH3 entering
HCy (as NH3) formed 1000°C.
1100°C
1000°C
HCy (as NH3) formed
HCy (as NH3) formed
915°C
HCy (as NH3) formed 860°C
Coal gas plus ammonia entering. c.c. per minute.

Fig. 2.

controlled mainly by temperature and accompanied by secondary reactions yielding the elements C, N_2, and H_2 by thermal decomposition of HCy and NH_3. Thus—

$$NH_3 + C \rightleftharpoons HCN + H_2$$
$$2NH_3 = N_2 + 3H_2$$
$$2HCN = H_2 + 2C + N_2$$

To test the correctness of this hypothesis, a mixture of coal gas and hydrocyanic acid was passed over the contact material used in previous experiments. The results are given in Table II.

TABLE II.—ACTION OF WOOD CHARCOAL ON HYDROCYANIC ACID.

The procedure adopted was similar to that employed in the experiments recorded in Table I. Conditions were varied as regards temperature only; rate of flow and volume and composition of reacting mixture remaining approximately the same throughout the series. The results are graphically represented in fig. 3.

INFLUENCE OF TEMPERATURE ON YIELD OF NH_3 AND DECOMPOSITION OF HCy.

"Slow" Rate of Flow, 79 to 85 c.c. per minute.

Wood Charcoal A.

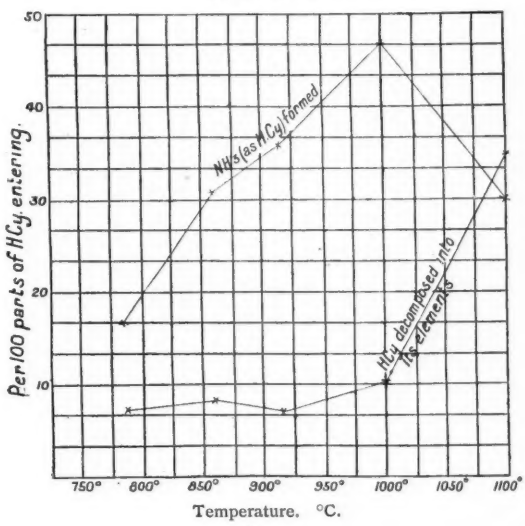

Per 100 parts of HCy entering
NH3 (as HCy) formed
HCy decomposed into its elements
750° 800° 850° 900° 950° 1000° 1050° 1100°
Temperature. °C.

Fig. 3.

From this we learn: (1) That the amount of hydrocyanic acid per cent. converted into ammonia reaches a maximum at 1000° C.; at 1100° C. there is a marked decrease in yield. (2) That the amount of hydrocyanic acid thermally decomposed, or converted into products other than ammonia, is small below 1000° C., and large at 1100° C. Thus: At 1000° C. HCy decomposed, 10·6 per cent.; at 1100° C., 35·5 per cent.

It is interesting to note that the contact material after use in these experiments showed marked loss of activity. The surface of the charcoal, further, was found to have lost the silvery appearance that characterizes it after treatment with coal gas alone or coal gas and ammonia, and had acquired a distinct bronze lustre

TABLE II.—*Action of Wood Charcoal on Hydrocyanic Acid—"Slow" Rate of Flow.*

0° C. 760 m.m.	Wood Charcoal (A). Volume, 230 c.c.; Weight, 55 grammes.				
	785° C.	860° C.	915° C.	1000° C.	1100° C.
Experiment No.	**13.**	**14.**	**15.**	**16.**	**17.**
Rate of flow . c.c. per min.	79	83	85	81	85
Duration of experiment, mins.	52	50	48	51	49
Coal Gas entering . . c.c.	4005	3995	3950	4025	4035
Hydrocyanic acid (pure, dry) . . . . . c.c.	126	136	131	124	140
Reacting mixture:—					
HCy, volume per cent. . .	3·0	3·2	3·2	3·0	3·3
Time in tube . . . secs.	91	87	85	89	84
Hydrocyanic acid balance:—					
HCy (as NH_3) entering grammes	0·096	0·104	0·100	0·094	0·107
HCy, products per cent.:—					
Undecomposed . . .	76·0	60·6	57·0	42·6	34·6
As ammonia	16·7	30·8	36·0	46·8	29·9
Decomposed (by diff.) .	7·3	8·6	7·0	10·6	35·5
	100·0	100·0	100·0	100·0	100·0
Calculated increase volume of exit gases due to dissociation of hydrocarbons . . c.c.	−25	+110	+120	+220	+705

when viewed by reflected light. The loss of efficiency and altered physical character is attributed to deposition of carbon upon the surface from thermal decomposition of hydrocyanic acid.

TABLE III.—DILUENTS—COAL GAS AND HYDROGEN COMPARED.

It has been stated already that ammonia gas in absence of methane will remove the graphitic skin from the surface of coated wood charcoal. Comparative experiments on a wood charcoal contact with coal gas and hydrogen as diluents are of very little value unless precautions are taken to ensure that the charcoal is properly coated with graphitic carbon throughout the series. In the present research, this was ensured by arranging that an experiment with hydrogen as diluent was preceded and followed by similar experiments in which coal gas was used. The results are given in Table III. Conditions as regards rate of flow, volume, and composition of reacting mixture, and temperature, remained practically constant throughout the series.

TABLE III.—*Interaction of Methane and Ammonia. Diluents Coal Gas and Hydrogen compared. "Slow" Rate of Flow. Temperature, 1000° C.*

0°C. 760 m.m.	Wood Charcoal (B). Volume, 230 c.c.; Weight, 55 grammes.					
	Coal Gas.		Hydrogen.		Coal Gas.	
	Entering.	Leaving.	Entering.	Leaving.	Entering.	Leaving.
Experiment No.	**18**		**19**		**20**	
Diluent gas entering c.c.	3790	4480	3880	..	3750	..
Per 100 volumes:—						
CO_2	0·2	0·1	..	..	..	0·1
O	0·5	0·2	0·1	..	0·7	0·2
CO	22·6	20·0	..	0·6	19·5	17·4
CH_4	22·9	14·8	..	..	25·3	15·4
H	48·7	59·0	99·5 (by diff.)	98·1	50·2	60·6
N	5·1 (by diff.)	5·9 (by diff.)	0·4 (calculated).	1·3 (by diff.)	4·3 (by diff.)	6·3
	100·0	100·0	100·0	100·0	100·0	100·0
Rate of flow . c.c. per min.	88	..	83	..	83	..
Duration of experiment . . . mins.	49	..	52	..	51	..
Ammonia (pure, dry), c.c.	485	..	439	..	458	..
Reacting mixture:—						
NH_3, volume p. ct.	11·3	..	10·2	..	10·9	..
Time in tube, secs.	82	..	87	..	87	..
Ammonia balance:—						
NH_3, entering grammes	0·370	..	0·335	..	0·349	..
NH_3, products per cent.:—						
Undecomposed . .	..	38·4	..	10·4	..	32·4
As hydrocyanic acid. . . .	..	25·9	..	22·7	..	27·8
Decomposed (by diff.) . . .	..	35·7	..	66·9	..	39·8
	..	100·0	..	100·0	..	100·0
Methane balance:—						
CH_4 entering, calculated as carbon . grammes	0·490	..	Nil	..	0·507	..
CH_4, products per cent:—						
Undecomposed .	..	72·9	..	..	..	73·6
Oxidized to CO .	..	(−·4)	..	..	..	6·3
As hydrocyanic acid . . .	..	13·5 (27·1)	..	..	..	13·4 (26·4)
As solid carbon (by diff.) . .	..	14·0	..	..	..	6·7
	..	100·0	..	..	..	100·0
Calculated increase volume of exit gases due to dissociation of hydrocarbons c.c.	..	+ 200	..	+ 1	..	+ 260

TABLE IV.—EFFECT OF DILUTION.

Conditions were approximately constant as regards rate of flow, volume of reacting mixture, and temperature for each pair of experiments. The necessary reduction in the volume of ammonia employed was effected by diluting the ammonia in the mercury cylinder with dried coal gas; the amount of gas so used being included in the figure "Coal gas entering."

The results indicate that dilution at "slow" rate of flow is unfavourable to yield of hydrocyanic acid, but favourable to conservation of ammonia.

TABLE IV.—*Effect of Dilution. Interaction of Methane and Ammonia. "Slow" Rate of Flow.*

0° C. 760 mm.	Wood Charcoal (A). Volume, 230 c.c.; Weight, 55 grammes.					
	915° C.		1000° C.		1100° C.	
	Ammonia in Reacting Mixture. Per Cent. by Volume.		Ammonia in Reacting Mixture. Per Cent. by Volume.		Ammonia in Reacting Mixture. Per Cent. by Volume.	
	10·8	5·7	10·8	5·4	11·2	5·6
Experiment No.	**2**	**21**	**3**	**22**	**4**	**23**
Rate of flow .c.c. per min.	85	83·9	82	82·5	87	85·7
Duration of experiment mins.	50	50	51	50	50	50
Coal gas entering. . c.c.	3,800	3,955	3,750	3,900	3,910	4,050
Ammonia (pure, dry) c.c.	457	238	453	222	466	237
Reacting mixture: Time in tube . . . . . secs.	86	86	87	87	82	84
Ammonia balance:—						
NH_3 entering, grammes	0·348	0·182	0·345	0·169	0·355	0·181
NH_3, products per cent.:—						
Undecomposed . . .	86·9	90·7	62·3	78·8	30·5	39·3
As hydrocyanic acid .	5·9	4·9	17·7	10·6	22·9	20·4
Decomposed (by diff.) .	7·2	4·4	20·0	10·6	46·6	40·3
	100·0	100·0	100·0	100·0	100·0	100·0
Calculated increase volume of exit gases due to dissociation of hydrocarbons c.c.	+ 130	+ 1	+ 255	+ 40	+ 740	+ 600

TABLE V.—CONTACT MATERIALS, WOOD CHARCOAL (COATED AND UNCOATED), HARD SCURF, AND GRANULAR CARBON, COMPARED.

Comparison is made in this table between the efficiencies of two forms of retort carbon and that of wood charcoal, coated and uncoated. Conditions as regards temperature, rate of flow, volume, and composition of reacting mixture were approximately constant throughout the series. The calculated free space in the tube, however, in the case of the "granular" carbon so much exceeded that in the case of the wood charcoal and "hard scurf," owing to the physical condition of the granules, that it is thought better to exclude this from consideration when discussing the results.

Comparing the results obtained with the remaining three contact materials, we see that the scurf is an active promoter of the thermal decomposition of ammonia. The yield of hydrocyanic acid, on the other hand, is low.

TABLE VI.—INTERACTION OF ETHYLENE AND AMMONIA.

An enriched coal gas was used as diluent. Conditions throughout were approximately constant as regards rate of flow, temperature, volume, and composition of reacting mixture, and time of gas in tube. The ethylene experiments, Nos. 28 and 29, were preceded and followed by corresponding experiments with coal gas, Nos. 27 and 30, to ensure that the contact material was acting normally.

The results clearly indicate that the presence of ethylene in the reacting mixture is favourable to the productiom of hydrocyanic acid and to conservation of ammonia. It is probable that the survival of ammonia is materially assisted by the large dilution

TABLE V.—*Interaction of Methane and Ammonia. Contact Materials, Wood Charcoal, Graphitic Scurf, and Granular Carbon, compared. "Slow" Rate of Flow. Temperature, 1000° C.*

0° C. 760 mm.	Wood Charcoal (A). Volume, 230 c.c.; Weight, 55 Grammes.		Hard Scurf from Coal-Gas Retort. Volume, 230 c.c.; Weight, 200 Grammes.	Granular Carbon Deposited from Purified Coal Gas. Volume, 230 c.c.; Weight, 43 Grammes.
	Uncoated with Graphitic Carbon.	Coated with Graphitic Carbon.		
Experiment No.	**24**	**3**	**25**	**26**
Rate of flow . c.c. per min.	82	82	88	85
Duration of experiment, mins.	50	51	49	51
Coal gas entering . . c.c.	3665	3750	3850	3825
Ammonia (pure, dry) . c.c.	459	453	484	483
Reacting mixture:—				
NH_3, volume per cent. . .	11·1	10·8	11·2	11·2
Time in tube . . . secs.	88	87	82	..
Ammonia balance:—				
NH_3 entering . . grammes	0·350	0·345	0·369	0·368
NH_3, products per cent.:—				
Undecomposed. . . .	28·0	62·3	24·7	52·0
As hydrocyanic acid . .	30·7	17·7	8·8	10·6
Decomposed (by diff.) .	41·3	20·0	66·5	37·4
	100·0	100·0	100·0	100·0
Calculated increase volume of exit gases due to dissociation of hydrocarbons . . c.c.	..	+ 255	+ 170	+ 180

TABLE VI.—*Interaction of Ethylene and Ammonia. "Slow" Rate of Flow. Temperature, 1000° C.*

C. 760 mm.	Wood Charcoal (B). Volume, 230 c.c.; Weight, 55 grammes.				Hard Scurf from Gas-Retort. Volume, 230 c.c.; Weight, 200 grammes.	
	Coal Gas.	Per Cent. of Ethylene in Coal Gas used.		Coal Gas.	Coal Gas.	Coal Gas Containing 19·4 per Cent. Ethylene.
		15·6.	26·7.			
Experiment No.	**27**	**28**	**29**	**30**	**25**	**31**
Rate of flow. c.c. per min.	82	86	81	82	88	86
Duration of experiment mins.	51	50	52	52	49	51
Gas entering (coal gas plus ethylene) . . . . c.c.	3,745	3,840	3,750	3,815	3,850	3,915
Ammonia (pure, dry). c.c.	458	472	459	469	484	493
Reacting mixture:—						
NH_3, volume per cent. .	10·9	10·9	10·9	10·9	11·2	11·2
Time in tube . . secs.	87	84	89	87	82	83
Ammonia balance:—						
NH_3 entering . grammes	0·349	0·359	0·350	0·357	0·369	0·375
NH_3, products per cent.:—						
Undecomposed . . .	32·4	38·4	38·0	33·6	24·7	54·6
As hydrocyanic acid .	27·8	30·9	31·7	26·6	8·8	13·1
Decomposed (by diff.) .	39·8	30·7	30·3	39·8	66·5	32·3
	100·0	100·0	100·0	100·0	100·0	100·0
Calculated increase volume of exit gases due to dissociation of hydrocarbons c.c.	+ 260	+ 525	+ 725	+ 300	+ 170	+ 540

brought about by thermal decomposition of the ethylene; but such dilution would be unfavourable to production of hydrocyanic acid (Table IV.).

RELATION OF HYDROCYANIC ACID TO AMMONIA IN CRUDE COAL GAS.

It is interesting to observe that the relation of hydrocyanic acid to ammonia in the laboratory experiments described above is controlled mainly by temperature. Indeed, so markedly is this the case, that a knowledge of this relationship for the graphitic contact material used in the experiments would enable one, with rough approximation, to deterime the tempe rature of the carbon with which the reacting mixture had been in contact. Thus, calculating the amount of hydrocyanic acid (as ammonia) per 100 parts of ammonia remaining undecomposed, for each of the temperatures and rates of flow in Table I., we find:

Wood Charcoal (A). Coated with "Graphitic" Carbon.

NH_3 in Reacting Mixture, 11 Per Cent.

—	Time in Tube.	860° C.	915° C.	1000° C.	1100° C.
	Secs.				
"Slow" rate . .	85	3·8	6·8	28·4	75·2
"Slower" rate .	174	5·0	10·4	33·6	62·5
"Slowest" rate .	342	5·1	9·0	41·7	43·9

The "hard scurf," Table VI., Experiment No. 25, gave much the same result. Thus, for 11 per cent. NH_3 at 1000° C. "Slow" rate; gas 82 secs. in tube. 35·6 per cent. HCy (as ammonia) per 100 parts of ammonia undecomposed. A similar relationship is found to exist for other dilutions of ammonia. Thus, Table IV.:

Wood Charcoal (A). Coated with "Graphitic" Carbon.

NH_3 in Reacting Mixture, 5·5 Per Cent.

—	Time in Tube.	915° C.	1000° C.	1100° C.
	Secs.			
"Slow" rate . . .	85	5·4	13·5	52·0

The conclusion here reached relates strictly to the reactions that take place under the experimental conditions observed in the laboratory; and it is not permissible to assume, without strict inquiry, that conditions even remotely similar will exist in gas-works practice and govern the relation of hydrocyanic acid to ammonia in crude coal gas. Probably the working of a vertical retort of the continuous type most nearly approaches that of the laboratory tube adopted in this research; but the similarity is by no means a close one, as conditions in respect both of contact material and temperature were uniform throughout the laboratory tube from end to end, while in a vertical retort experience shows that carbonization proceeds at different speeds at differing levels, and notably in the same horizontal section, more especially in the upper half of the retort. It is therefore quite impossible, with any degree of certainty, to ascertain the temperature conditions under which the gases are evolved, and to which they are exposed in their subsequent passage to the outlet. The conditions diverge, perhaps, to a still greater extent when we come to consider the nature of the diluent gases in the two cases. The products of distillation of coal are so numerous, and differ so widely in their chemical and physical properties, that it would be quite impossible to reproduce in the laboratory conditions existing in this respect in gas-works practice; and a number of assumptions have necessarily to be made that materially lessen the value of the conclusions drawn from laboratory experiments when the chemist attempts to apply them to large-scale operations. Moreover, the genesis both of ammonia and hydrocyanic acid in the distillation of coal remains very much a matter for speculation. It is evident that the ammonia found in the crude coal gas leaving the gas-retorts may be derived from the nitrogen of the coal in many ways—by the agency of nascent hydrogen, by the decomposition of nitrogenous bodies present in the coal or produced therefrom on distillation, and, lastly, by decomposition of hydrocyanic acid, either alone or by interaction of hydrogen ($HCN + H_2 \rightleftharpoons NH_3 + C$), or steam ($HCN + H_2O \rightleftharpoons NH_2 + CO$).

In the same way, hydrocyanic acid may be a direct product of the decomposition of nitrogenous organic bodies, or may be obtained as a product of the decomposition of ammonia in presence of carbon, gaseous or solid, in accordance with the reversible reaction given above. We cannot exclude the possibility of the direct production of hydrocyanic acid, as the lower limit for its formation from ammonia appears to lie at or slightly below 700° C.; whereas cyanogen compounds have been found in considerable amount in ammoniacal liquors obtained in the manufacture of "coalite" by the distillation of coal at temperatures stated not to exceed 800° to 850° Fahr. (427° to 454° C.)—see report for 1908.

However, whatever be the source of the ammonia and hydrocyanic acid, both these bodies are normal constituents of crude coal gas when generated by the distillation of coal at temperatures whose upper limit within the retort may be taken to be about 2000° Fahr. (1100° C.); and, when generated, it is reasonable to infer that the relative amounts of these constituents tend to attain an equilibrium determined by the nature and temperature of the material with which they are in contact, the time of contact therewith, and the degree of dilution and nature of diluent gases present.

Exact data are wanting for determining the relation of hydrocyanic acid to total ammonia in crude coal gas as it leaves the retort. Mr. James M'Leod published the results of a number of determinations of the nitrogen found in the products of distillation of eighty coals in use at the Provan Gas-Works (see "Journal of the Society of Chemical Industry," 1907, Feb. 28, pp. 137-139);* but the estimation of the cyanogen present in the gas was made at the exit of the scrubbers, and no account was taken of the cyanogen present in the "virgin" and scrubber liquors as cyanide, thiocyanate, and ferrocyanide. Correcting for this, we have—

	Per Cent. of Total Nitrogen.
Nitrogen in the coke	58·3
,, in the tar	3·9
,, in ammoniacal liquor as ammonia . . .	17·1
,, as cyanogen (corrected)	1·5
,, in gas (by difference)	19·2

No figures are given, however, for the average time of the gas in the retorts, nor for the dilution of ammonia per cent. in the crude coal gas.

Mr. M'Leod considers that the amounts of cyanogen and ammonia produced are governed by the following factors: "(1) The physical condition of the coal when introduced into the retort.

* See "JOURNAL," Vol. XCVII. p. 748.

If the lumps are very small, the heat takes longer to penetrate the whole charge; and consequently the products differ. (2) The amount of extraneous moisture the coal contains. Practical experience shows an increased amount of carbonic acid, sulphuretted hydrogen, tar, and ammonia if the coal is wet. (3) The temperature of the distillation. High heats produce a marked increase in the amount of cyanogen, and also influence the amount of nitrogen retained by the coke."

As regards the conclusions reached by Mr. M'Leod, the present research, of necessity, can afford no confirmation or otherwise with respect to factor (1). As regards factor (2)—the amount of extraneous moisture—attention was directed in the annual report for 1904 to the conditions under which the reaction $HCN + H_2O = NH_3 + CO$ is operative. The combined oxygen present in the coal would be also a source of aqueous vapour. The importance of temperature factor (3) has been emphasized elsewhere. In addition, the time of gas in the retort and degree of dilution of ammonia in the crude coal gas are factors that must not be overlooked in an exhaustive study of the question.

More complete data have been recently published (1909) by Dr. Harold G. Colman, in his various tests of the Glover-West vertical retort at St. Helens, and recorded in the technical journals.* The installation in question consisted of a setting containing eight vertical retorts 20 feet in length, heated by gaseous firing from a generator combined with the plant. The gas produced was condensed and purified in a plant entirely separate from that dealing with the gas from the horizontal retorts; the gas passing through a dry main to the foul main, thence through a set of vertical atmospheric condensers to the exhauster, after which it traversed successively a washer, a scrubber, and an oxide purifier, passing thence to the meter. The gas was sampled for estimation of hydrocyanic acid at the inlet to the washer. A correction is therefore needed for cyanogen condensed with the virgin liquors in the condenser. It will be sufficient for our purpose to assume that 25 per cent. of the hydrocyanic acid leaving the retort is condensed with the virgin liquor, and is retained thereby as cyanide, ferrocyanide, and thiocyanate. Calculating on this basis from Dr. Colman's results, we find—

GLOVER-WEST VERTICAL RETORT AT ST. HELENS.

Tests Taken on Different Dates, and with Various Coals in Use.

—	A.	B.	C.	D.
Per cent. NH_3 in crude coal gas	1·6	1·1	0·9	1·1
Per cent. HCy (as NH_3) to total NH_3	17·9	21·7	30·7	25·4

Dr. Colman gives no temperature data, nor is it possible from his figures to determine the time spent by the coal gas in the retort. Mr. Thomas Holgate estimated that for a horizontal retort (partially filled) the time of the gas in the retort (calculated for gas at 30 inches bar., 60° Fahr.) would be 2·7 minutes (= 162 seconds) at the start to 5·6 (336 seconds) at the end of distillation (see the report for 1908); but such limits would not be applicable to a fully-charged vertical retort continuously generating gas. In the laboratory experiments on "graphitic scurf" above referred to, the time of gas in the tube (calculated for 30 inches bar. and 60° Fahr.) would be about 77 seconds.

Further data are required before any conclusion can be safely drawn as to the connection existing between carbonization temperature and relation of hydrocyanic acid to ammonia in the crude coal gas as it leaves the retort. In the works, further knowledge is required of the distribution of temperature in the retort and of the relation of hydrocyanic acid to ammonia in the crude coal gas as it leaves the retort and before condensation has taken place. In the laboratory, the work has to be extended to include experiments on ammoniacal mixtures down to 1 per cent.; and, further, to study the effect of varying the nature and amount of ash in the graphitic contact used. It may well be found that a high percentage of ash, and especially of ash containing iron compounds, is very detrimental to the survival of ammonia and hydrocyanic acid in the reacting gases.

Mr. Carpenter concludes his report as follows: I regret that continued ill-health has precluded my doing more than generally supervise the preparation of this report, which proceeds from Mr. Linder's pen. I desire fully to recognize the great value of his services to the work of the Department. He has conducted the experimental work, the results of which are recorded here, with conspicuous ability and zeal. The whole credit for this research, if the work possesses value, is really entirely due to him.

* See "JOURNAL," Vol. CVII., p. 166; Vol. CVIII., p. 42.

Gas and Electricity Supply at Krupp's Works.—In the last report of the Essen Chamber of Commerce, some interesting particulars are given respecting the great works of Krupp, at Essen, to which 68,905 employees (6840 being officials) were attached on May 1 last. The firm have works which produced 652½ million cubic feet of gas for lighting 2004 street lamps and for use in 32,207 workshops, offices, and dwelling-houses. Beyond this, the central electric generating station produced 39,640,000 kilowatts of electric energy, compared with 25,541,000 kilowatts in the year 1908.

ILLUMINATING POWER AND CALORIFIC VALUE OF GAS IN CANADA.

Report to the Canadian Gas Association.

The subject of the illuminating power and the calorific value of the gas supplied in Canada was brought before the members of the Canadian Gas Association in a report submitted by a Committee at the third annual meeting, held in Hamilton (Ont.) last month, under the presidency of Mr. J. S. Norris, of Montreal. The Committee, consisting of two members (Messrs. Arthur Hewitt and John Keillor), was appointed at the preceding meeting, when a paper was read on "The Candle Power of Gas," which brought out the following facts and suggestions: That there had been no change for 24 years in the Dominion Government Statutes regulating the testing of gas and the candle power to be supplied. That during this period the methods of using gas had so totally changed that there was no longer any necessity for gas companies in Canada to supply to consumers the quality of gas prescribed by the Gas Inspection Act of 1886. That in other countries—notably Great Britain and Germany—the regulations governing the testing of gas had been revised to suit the new methods of using gas, and the candle power had been reduced. That in other countries more modern and efficient burners for testing the candle power of the gas had been adopted, notably the "Metropolitan" No. 2 burner, and the old standard argand burner discarded. That, in view of the fact that about 90 per cent. of the total gas made in Canada was being sold for purposes other than flat or open flame lighting, it was suggested that tests should be made in Canada of from 12 to 20 candles, for the special purpose of ascertaining the respective candle power and heating values of the gases lower than 16 candles; the idea being to obtain certain information which would guide the Association in recommending a reduction to a lower-grade candle-power gas which would still contain sufficient heat units for the all-round requirements of the consumers.

Following the lines indicated, the Committee decided to make the tests in Toronto, where coal gas and water gas are made, and a blend of the two distributed to consumers, the tests to be made as follows: (1) For candle power, using the Sugg 16-candle standard and the pentane lamp; the calorific value to be measured by the Junkers calorimeter. (2) For candle power, using the new "Metropolitan" No. 2 burner and the pentane lamp; the calorific value to be measured by the Junkers calorimeter.

It was also considered that the Association should be in possession of statistics covering the entire gas production of Canada, for the purpose of ascertaining first hand the total quantity of gas made, its candle power, and the proportions sold for heat and fuel, incandescent lighting, &c. Accordingly, a circular-letter was sent to every gas company in the Dominion making coal gas, water gas, or a mixture of the two, requesting them to supply the information the Committee desired. Returns were received from all but two companies; and they are tabulated below.

—	Gas Made, Thousand Cubic Feet.	Proportions (Thousand Cubic Feet) Used for			Candle Power Supplied.
		Heat and Fuel.	Incandescent Lighting.	Open Flame Lighting.	
Barrie	12,000	6,000	5,400	600	18·0
Belleville	20,200	10,200	7,500	2,500	19·3
Berlin	35,000	26,250	6,750	2,000	16·7
Calgary	27,000	20,250	6,750	..	16·0
Cobourg	7,400	4,400	1,500	1,500	18·1
Guelph	44,000	26,400	13,200	4,400	17·5
Hamilton	101,000	53,500	38,000	9,500	16·0
Ingersoll	12,000	6,000	4,800	1,200	16·0
Kingston	40,000	20,000	20,000	..	20·0
Listowel	3,000	300	2,250	450	19·0
London	192,000	115,200	67,200	9,600	17·5
Montreal	1,459,000	875,000	510,600	75,000	17·4
Napanee	5,000	2,500	2,500	..	20·0
Nelson	7	5,000	2,100	..	18·0
Owen Sound	18,000	10,800	3,600	3,600	16·0
Oshawa	4,000	2,000	1,840	160	17·0
Ottawa	126,500	113,850	12,650	..	16·5
Peterboro'	17,000	16,150	850	..	18·0
Quebec	120,000	72,000	45,600	2,400	18·0
Stormont	4,000	1,600	2,000	400	18·0
St. Catharines	18,650	13,100	5,550	..	18·0
St. John	36,200	1,800	30,800	3,600	17·0
St. Thomas	56,200	22,500	22,500	11,200	17·3
St. Hyacinthe	5,000	4,000	800	200	18·0
Toronto	2,226,200	1,113,200	667,800	445,200	19·0
Vancouver	123,000	95,900	27,100	..	16·0
Winnipeg	245,600	184,000	49,300	12,300	17·0
Woodstock	30,000	15,000	14,400	600	16·7

According to these returns, the total quantity of gas made in Canada last year, exclusive of the companies not making returns, was 4,995,050,000 cubic feet; and it was used in the following proportions for the purposes named:—

	Cubic Feet.	Percentage of Total Make.
Heat and fuel	2,837,300,000	57
Incandescent lighting	1,573,340,000	32
Open-flame lighting	584,410,000	11
Total	4,995,050,000	100

The following are the returns of ten tests for illuminating power and calorific value of (A) coal gas, (B) water gas, and (C) a mixture of coal and water gas in the proportions of 75 per cent. of the former and 25 per cent. of the latter; the tests being made with Sugg's 16-candle standard and the Junkers calorimeter :—

(A)			(B)			(C)		
Candle Power.	Calorific Value.		Candle Power.	Calorific Value.		Candle Power.	Calorific Value.	
	Gross.	Net.		Gross.	Net.		Gross.	Net.
17·85	652·6	584·06	17·46	587·30	536·67	15·64	587·30	533·09
17·46	677·3	621·98	19·42	585 70	535·35	16·06	601·30	541·37
17·72	662·0	598·01	19·92	600·00	586·01	17·31	623·60	578·14
16·92	621·8	575·74	19·43	592·42	555·59	19·42	631·90	599·30
17·38	685·1	630·04	17 52	617·20	580·28	18·33	626·40	575·29
18·53	703·0	647·84	20·20	610·50	587·33	18·29	626·30	575·79
17·81	665·3	605·20	21·72	612·40	577·48	17·39	621·10	575·22
10·68	674·6	593·53	20·77	612·10	572·39	17·32	612·50	576·33
16 85	626·8	584·53	18·53	565·00	538·33	18·41	629·60	581·30
16·22	614·4	557·00	18·08	570·60	538·50	17·34	614·08	554·82

The following are the returns of ten similar tests, using the "Metropolitan" No. 2 argand burner:—

(A)			(B)			(C)		
Candle Power.	Calorific Value.		Candle Power.	Calorific Value.		Candle Power.	Calorific Value.	
	Gross.	Net.		Gross.	Net.		Gross.	Net.
17·79	587·3	533·09	22·48	605·1	554·34	21·06	624·0	610·19
18·38	590·8	558·68	22·83	604·1	557·15	21·15	638·9	589·70
19·58	653·7	598·32	23·53	625·0	592·36	21·92	668·4	603·13
19·15	607·5	560 70	22·91	614·4	563·82	22·59	634·7	592·91
19·30	614·3	554·69	25·10	612·4	577·48	22·60	609·9	572·67
20·48	644·0	588·12	21·94	570·6	538·50	21·59	621·3	569·91
20·74	667·6	611·65	21·70	565·0	538·33	21·63	610·5	576·29
21·40	639·8	586·52	22·09	590·8	558·68	19 85	632·2	590·54
21·11	631·7	575·60	21·37	598·3	593·65	22·09	626·4	575·29
20·54	621·0	565·34	23·68	610·5	587·33	20 54	623·6	578·14

The following are the returns of fifteen tests for illuminating power and calorific value of pure coal gas, using Sugg's 16-candle standard and the Junkers calorimeter :—

Candle Power.	Calorific Value.		Candle Power.	Calorific Value.	
	Gross.	Net.		Gross.	Net.
11·76	575·25	538·36	16·71	644·0	588·12
11·87	548·20	501·69	17 27	639·8	586·52
13·83	603·90	546·76	17·81	665·3	605·20
14·32	607·50	560·70	18·03	633·1	579·38
15·56	610·40	575·57	18·28	648·0	578·92
15·83	633·30	577·59	18·68	674·6	593·53
16·06	627·30	557·62	19·00	669·0	611·30
16·17	632·10	571·57			

On the general subject of their investigations, the Committee made the following remarks.

From the first tabulated statement, it will be observed that out of the total gas made in Canada 57 per cent. is used for heat and fuel, 32 per cent. for mantle lighting, and 11 per cent. for open-flame lighting. We desire especially to draw attention to the small percentage used for open or flat flame lighting (11 per cent.), compared with the large proportion used for heat and fuel and mantle lighting combined—89 per cent. Compare these with the proportions of gas used for the same purposes in 1886, when the existing testing regulations were enacted :

	In 1886. Approximately.	In 1910. Actual.
For heat and fuel	15 p. ct.	57 p. ct.
For lighting by mantle burners	*nil*	32 ,,
For lighting by luminous or flat-flame burners	90 ,,	11 ,,

These figures show how radically changed are the conditions to-day, in the matter of using gas, compared with 1886. In that year, when the argand burner was adopted by the Government as the standard burner for testing gas, 90 per cent. at least of the total gas sold was for lighting by luminous or open-flame burners. This necessitated making gas of high candle power, so that with the standard burner a light equal to at least 16 candles could be obtained; the gas being consumed at the prescribed rate of 5 cubic feet per hour. In 1886, the Government decided that gas companies would have to maintain a 16-candle standard—a regulation intended to protect the consumers who used those luminous flame burners against the possibility of getting poor light. But, remember, that was in 1886—24 years ago. The argand and flat-flame burners were the only ones in general use then, and practically all the gas made was used by these burners. Look at the changed conditions in 1910. Only 11 per cent. of the total gas made is now used by luminous-flame burners, against 90 per cent. 24 years ago. To-day as much as 89 per cent. of the gas made is being used for the combined purposes of heat, fuel, and mantle lighting; in 1886, approximately 10 per cent.

Taking into consideration these changed conditions of using gas, it is evident that what the gas industry is called upon to supply to-day, and in the future, is not a lighting but a fuel gas. We do not push the sale of a single gas appliance nowadays that necessitates the making of high candle-power gas. The gas-range, water-heater, gas-engine, industrial furnace, gas-arc, gas-fan, &c., can all be well served with a lower-grade gas than that prescribed by the Act of 1886.

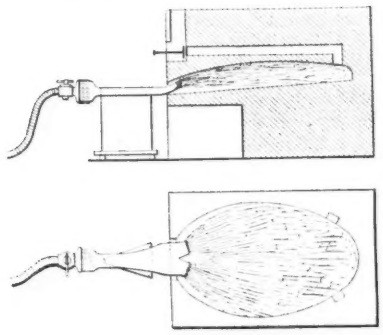
Turn, now, to the other tabulated statements. These tests were made for the purpose of obtaining some reliable information, based on Canadian practice, to lay before the Deputy-Minister and Chief Electrical and Gas Inspector, should the Association decide to recommend a reduction of the candle power or the substitution of a calorific standard in its stead. There is no doubt in the minds of your Committee that the calorific standard will eventually supersede the candle standard in Canada; but how far the Government are prepared to go in the matter at this time, we have no means of knowing. At any rate, it is safe to assume that, when it is made known to the authorities, in the opinion of the Canadian Gas Association, a change in the Statutes is necessary, in view of the radically changed conditions of using gas, either a reduction of the candle standard will be granted, or that standard will give place entirely to the calorific standard.

Two important facts are to be deduced from the tabulated results of the tests referred to: (1) That coal gas of about 13-candle power as tested by the Sugg 16-candle standard, containing about 540 B.Th.U. net, is sufficiently high in heat units for all practical requirements and the "Metropolitan" No. 2 burner. (2) The difference in the efficiency of the old Sugg 16-candle standard burner and the new "Metropolitan" No. 2 burner, when testing gases lower than 16 candles, is very marked. But this is to be expected, because whereas the Sugg standard burner is made to test 16-candle gas only, the "Metropolitan" burner, with its adjustments, can be adapted to test correctly any gases higher or lower than 16 candles.

HEATING BAKERS' OVENS BY GAS.

The members of the Société Technique du Gaz en France who attended the recent congress in Paris, and afterwards accepted the invitation of the Council of the Belgian Association of Gas Managers to visit Brussels, had their attention directed in both cities to the subject of the use of gas for heating bakers' ovens. At the Paris meeting, it was introduced by M. Méker, who read a short paper describing the burner he has devised for the purpose; and in Brussels, M. Bromham, one of the Engineers at the Municipal Gas-Works, gave an explanation of the two ovens designed and constructed at these works, and in operation in the pavilion of the Belgian Association at the Exhibition.

Dealing first with the arrangement of M. Méker, whose name is well known in this country in connection with his heating burner, it may be said that it is the outcome of experiments, extending over two years, carried out under the auspices of M. Rouland, the Managing-Director of the Paris Gas Company, who generously gave facilities for making them. The problem M. Méker set himself to solve was the utilization of gas as a fuel in place of wood or coal in existing ovens, without necessitating any structural alterations. The first appliance tried consisted of about seventy of M. Méker's No. 3 burners, each consuming some 10½ cubic feet of gas per hour, or a total of 740 cubic feet. In consequence of the difficulties attending the lighting of such an appliance, M. Méker produced another, of the type of his multi-flame apparatus, in which the gas and air were supplied by separate injectors, and in which the gaseous mixture produced about 35 round flames 1½ inches in diameter. These results were more satisfactory; and, after two modifications, M. Méker fixed upon the appliance described and illustrated in his paper. It consists of a burner mounted upon movable framework, so that it can be brought up to the mouth of the oven. The supply of gas is furnished by a flexible metallic tube about 1¾ inches diameter, which will stand all the wear it is likely to be subject to.



Ordinary bakers' ovens are generally about 12 feet from front to back and 8 feet wide; the superficial area of the floor being, on an average, 80 to 90 square feet, and the height from the floor to the vault 12 inches, and sometimes more. Though ovens constructed to utilize solid fuel necessarily do not allow of gas being used to the greatest advantage, the results obtained by M. Méker are, he thinks, sufficiently interesting to justify managers in recommending the use of this fuel for the baking of bread in existing ovens. The accompanying illustrations show, in section and plan, an oven with the gas apparatus in position. The length of the heating period depends upon the effect to be produced and the pressure of gas. For heating the first batch, gas has to be burnt from two to three times as long as for the succeeding batches, as there is comparatively little heat in the oven at the start. But from the point of view of the duration of work, there is great advantage in heating by gas. On the first batch

alone there is a gain of at least an hour, and a quarter-of-an-hour on each succeeding one.

M. Méker was unable to give exact results with respect to the consumption of gas in relation to the quantity of flour or dough baked; but he gave some figures subject to a variation of 25 per cent. and upwards, according to circumstances. To bake in one night bread corresponding to a weight of about 11 cwt. of flour, in seven batches of various kinds—one-third being fancy bread—required 2100 cubic feet of gas. These figures refer to an average oven forming part of a fairly large bakery. In the trials carried out by the Paris Gas Company, the men worked quite normally with the appliance—some for two and others for five months—with the greatest satisfaction. M. Méker thought that it would be interesting to call gas managers' attention to the fact that it is possible to put into the hands of quite inexperienced people, as he had done, appliances consuming from 700 to 1000 cubic feet of gas per hour. The trials were carried out without the slightest accident. Reverting to the question of cost, he said that in Paris it appeared to be, on an average, 1s. 4d. per batch in the case of ordinary ovens heated by wood; and he considered that where gas is sold at about 3s. 8d. per 1000 cubic feet it could compete economically with solid fuel.

M. Méker summed up the matter as follows: It is possible to heat existing ovens by gas, without difficulty or fear of accident, by means of a safe and strong appliance; the quality of the bread is better than that baked with solid fuel; and the workmen are favourable to the use of gas, which facilitates and shortens their labour. The question of cost has to be considered in connection with each particular case and the local circumstances.

One of the speakers on M. Méker's paper was M. Bromham, who, as already mentioned, described, in the pavilion of the Belgian Association of Gas Engineers at the Brussels Exhibition, the two ovens on view there, with which demonstrations are given. The object in view when designing these ovens was, first of all, to obviate the necessity for a baker locating the oven in a cellar, which not only heats the house, but causes a great deal of dust when coke or wood is used as the fuel, both of which, of course, have to be stored, which takes up room. One of the principal advantages of the Brussels oven is that it can be placed anywhere. It is made in two compartments; and the gas is not burnt within, but is led round them in small pipes, so that the oven is hot when the batch is introduced. Consequently, if the oven is not hot enough to finish off the bread, more gas can be used to bring up the temperature to the required point. This arrangement has also the advantage of enabling a baker to bake small fancy bread or pastry while the oven is being heated for the heavier batch. The oven requires the consumption of 250 or 300 cubic feet of gas to heat it up again after a baking. The two compartments will hold about 300 lbs. of bread; and the gas required to bake 2 lbs. is 3½ cubic feet. The temperature required for baking bread is 460° to 500° Fahr.; and the time occupied is 50 to 55 minutes. Consequently, the oven can be filled every hour.

It appears from the foregoing particulars that the gas-heated bakers' oven should commend itself as an economical and cleanly appliance, especially in localities where the price of gas is lower than it is on the Continent, and where wood is dear.

DANGERS OF MIXED GAS AND ELECTRICITY APPLIANCES.

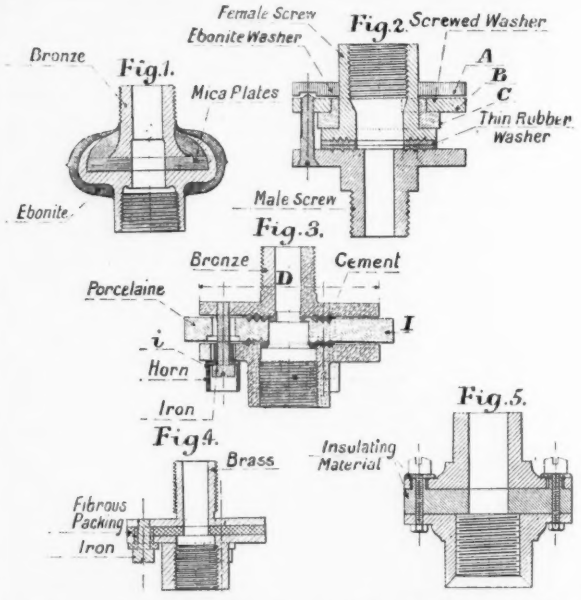
In the course of the review of the proceedings at the recent Congress of the Société Technique du Gaz en France, given in the "JOURNAL," for June 25, it was mentioned that the Committee had investigated the precautions to be taken in the employment of mixed gas and electricity appliances, and had prepared a report on the subject. It was read at the meeting by M. Bouvier; and the following is an abstract translation of it.

Electricians, and even those connected with gas lighting, having at times displayed distrust in fittings which allow of either system of lighting being used, a Committee of the Society instituted an inquiry into the particular sources of danger in the adoption of such appliances in domestic lighting, and also into the precautions which should be taken with a view to minimize the risks attending their employment. As is well known, any electric-light fitting, whether of the hanging or the wall-bracket pattern, can be insulated. Unless this be done, any contact between one of the electric connections and the body of the fitting will result in short-circuiting; and, as a result, there will be danger of fire. In the case of fittings serving for use on both systems of lighting, the need of proper insulation is more insistent, since the danger of fire is obviously greater under conditions where the passage of current may lead to leakage from a gas-main.

Nevertheless there is much to be said for the duplex fittings from the point of view of corporations supplying both gas and electric current, as well as of those producing the former only. Obviously, competition with electric light will be less acute if those employing electric illumination can at the same time retain fittings for use also with gas. This feature of the duplex fittings will appeal to companies supplying gas only; while those who supply both will succeed more readily in selling electric light to customers who have been using gas, if the latter can easily transform the fittings they already have. An electrical company, too, should see it is to their interest to encourage double fittings, not only for the commercial reasons just stated, but also because customers who have the two systems at command will complain less bitterly of a breakdown in the supply of one.

The precautions which may be taken in installing fittings for the double purpose referred to may therefore be assumed to be of importance to all classes. These precautions, according to the information collected by the Committee, are as follows: (1) The sockets employed for the lamps should invariably be those having the bottoms insulated. (2) Each fitting should be safeguarded from short-circuiting by means of a cut-out provided with a fuse so adjusted that the circuit is broken by the passage of a current one-and-a-half times that normally employed. (3) The fitting should be connected to the gas-pipe by means of an insulating union joint. The two first precautions do not call for comment. As regards the third, some further remarks are necessary.

A number of patterns of insulating unions are available; and they vary considerably in point of efficiency. In order to give satisfaction, an insulating union should have a resistance between its two armatures of at least 500,000 ohms; and this resistance should not be liable to reduction through use, or by accidents such as the deposition of dust, the fall of a metallic article, &c. Also, it should make a tight joint; and, having generally to support the weight of the fitting, it should offer ample resistance.



The insulating unions most commonly employed may be classified into three divisions. The first type (fig. 1) possesses in the highest degree the qualities of an ideal union. The end of both the male and female screws is firmly embedded in the insulating material—a construction which ensures a perfect joint. By making the two parts of the necessary thickness, any required strength may be attained; while it is very difficult to bring the parts accidentally into contact with a foreign body.

The type of union shown in fig. 2 is equally satisfactory; but in this case the perfection of the joint depends only on the threads, which have always a tendency to unscrew if subjected to constant vibration. Moreover—and this is the chief defect of the pattern—the metal washer B is always in contact with the lower junction through the threads; and therefore the insulation is liable to suffer through dust falling on the washer B, or on the upper part of the ebonite washer C; while the fall of a metal body on the washer B will entirely destroy the insulation. This type of union is greatly improved by covering the washer B with an insulating disc A, shown in cross hatching.

From this standpoint, the third type (fig. 3), which is somewhat similar to the preceding, affords a greater degree of safety; but if the heads of the screws do not properly fit the holes of the lower part of the union, the part I is liable to be cut, and there is thus danger of the fitting falling. Unions of the last type are the most common; but the simplifications or modifications made in them should usually be rejected. For example, the diameter D of the unions and of the ebonite disc I are frequently reduced in order to give the model the form shown in fig. 4. Here it will be seen that the chances of leakage are increased, and this, the greater the amount of thrust to which the union may be subjected. Moreover, the heads of the screws being no longer protected, accidental connection can easily be made between one of them and the external element of the union.

In other cases (see fig. 5), the screw-head is placed on the upper part of the union, where the presence of dust or a metal body reduces or entirely destroys the insulation it should give.

As a last recommendation, it may be mentioned that, for any fittings employed for both gas and electric light, the flexible cable carrying the two wires should be of the flat pattern, and of a description thoroughly well insulated (600 megohm series). It should, of course, be arranged so that it is not subjected to deterioration by the heat of the gas.

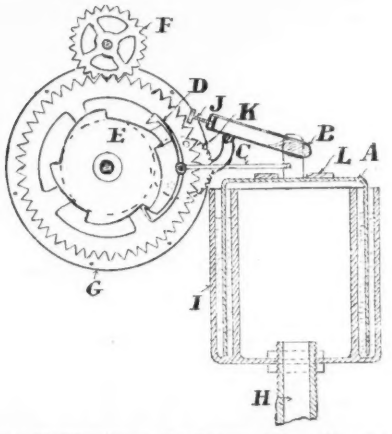
REGISTER OF PATENTS.

Automatically Turning On and Off Gas-Burners.

BLAKE, E. W., of South Croydon, Surrey.

No. 13,350; June 8, 1909.

This invention consists of an improved construction of the "Robson" automatic lighter, patent No. 20,109 of 1907; and the object of the invention is to provide apparatus which is to a certain extent self-regulating, so that the turning off of the gas at extinguishing time may be performed at a lower pressure than is required for turning on the gas at lighting time. Another object is to prevent the unintentional variations of pressure in the main from operating the apparatus during lighting periods.



Blake's Modification of the Robson Automatic Lighter.

A is a gas-tight bell; B an adjustable tube carrying the movable weight of mercury or other liquid; C a rigid lever fixed to the exterior of the bell A at one end and to the pawl D at the other; E is a ratchet wheel; F is a wheel directly connected to the plug of the gas cock or valve; G is a casing containing the operating spring; H is the gas inlet pipe; I is the outer casing carrying the liquid seal into which the lower end or rim of the bell A dips; J is an adjusting plug and screw for lengthening or shortening the tube B; K is a wheel with one or more stops or pegs for returning the liquid weight to the bell when the apparatus is in operation.

The apparatus acts as follows: The diaphragm or bell is always open to the existing gas pressure in the main, and has no valve of any description whatever between it and the main. It is weighted by the movable weight B, and may also, if desired, have one or more fixed weights L; and can be adjusted to operate at any desired pressure. When the pressure in the main is intentionally increased and reaches a predetermined point at which the apparatus has been set to operate, the pressure causes the bell A to rise, and in rising to take up with it the weight-carrying tube B, and, raising the loaded end of the tube above the centre or spindle on which it rocks, causes the mercury to flow by gravity to the other or opposite end of the tube, putting the tube into a more vertical position and quite clear of the bell. This provides a positive action for relieving the bell of the whole or a portion of its weight or weights during the lighting operation. The bell A, now being relieved of a portion of its weight (or, if so desired, the whole of its weights), the abnormal pressure rapidly causes the bell to complete the remainder of its upward movement or stroke, taking up with it the lever or bar C, which rocks the pawl D, releasing the lower end from the ratchet E, and at the same time allowing the spring G to come into action and operate, by means of the wheel F, a gas cock or valve, admitting gas to the main burner and shutting off gas to to the pilot light, when one is used in conjunction with the main burner. The action of the spring motor is checked by the upper end of the pawl D engaging with the next tooth on the ratchet E, which occurs directly gas has been admitted to the main burner.

The bell A remains up until a certain decrease of pressure occurs in the supply pipe or main, when the weight of the bell overcomes the pressure and returns to its former position. The bell, in descending, takes down with it the lever C, releasing the upper end of the pawl D from the ratchet E, and allowing the spring to again come into operation until the lower end of the pawl engages with the next tooth on the ratchet. This operation has partly turned the plug of the gas cock or valve, and put it into the position for extinguishing when the next operation takes place.

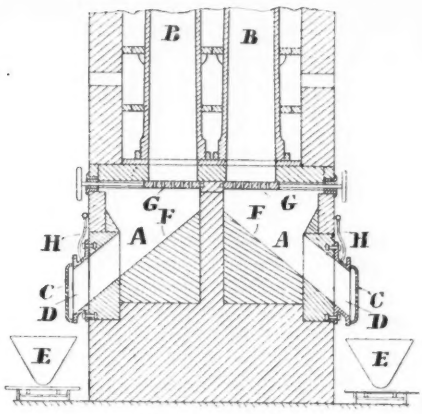
The pressure in the main is now slightly raised again; but not necessarily to the same high point as for the lighting operation. This small increase causes the bell A to again rise, taking up with it the lever C, releasing the lower end of the pawl D from the ratchet E, which again allows the spring to come into action, turning the wheel F, which operates the gas cock or valve extinguishing the main burner and putting on a supply of gas to the pilot light. The gas pressure in the main is at once brought back to the normal pressure again, so as to allow the bell A to fall, and, in falling, it carries down the lever C. Releasing the upper end of the pawl D from the ratchet E, the spring again comes into operation, bringing the stop or stops on the wheel K directly into contact with the lower end of the tube B, lifting or raising this end above the centre or spindle on which the tube rocks, causing the mercury in the tube to flow or fall to the other end, and thus causing weight to be again placed on the bell A.

Vertical Gas-Retorts.

EWING, W., of Glasgow.

No. 14,508; June 21, 1909.

This invention has for its object to provide an improved construction of vertical retorts whereby "the heat from the discharged incandescent coke is utilized to assist the carbonizing action, and in which, by the use of steam, the coke is gradually cooled, its quality is improved, and water gas is produced; while an increased amount of ammonia is obtained." A hermatically sealed chamber for the reception of the discharged coke is provided at the lower end of one or more of the retorts; and a perforated movable plate or valve is arranged between each hermetically sealed chamber and the lower end of one or more of the retorts.



Ewing's Vertical Retorts.

In the vertical section shown of a gas-retort setting, the closed chamber A, for the reception of the discharged incandescent coke (provided at the lower end of one or more retorts B), is fitted with a hermetically sealed discharge door C adapted to close an opening D for the passage of the coke to gravity buckets E or the like. Each chamber has a sloping wall F, down which the coke passes to the opening D. The lower end of each retort is adapted to be cut off partially from the chamber A by a perforated movable plate or valve G; so that carbonization may take place either continuously or intermittently—the plate being operated by suitable devices. Steam is introduced by a branch pipe H into the chamber A, and is arranged to pass upwards through the discharged coke retained temporarily in the chamber and through the coal in the retort when the plate G is open or closed—"thus gradually cooling the coke, making water gas, and increasing the amount of ammonia obtained."

The patentee intimates that he makes no claim to anything described in patents No. 23,650 of 1905, No. 7113 of 1895, No. 15,552 of 1891, No. 7952 of 1898, and No. 7953 of 1898.

Coin-Freed Mechanism.

HIBBERD, C. E., of Victoria Street, S.W.

No. 14,758; June 23, 1909. No. 16,141; July 10, 1909.

This invention relates to coin-freed mechanism, and, although applicable to machines adapted to receive only one size of coin, is more especially useful in a machine adapted to receive different valued coins, and provide an amount of a commodity corresponding to the value of the coin inserted. The mechanism, which may be applied to gas, electricity, or other meters, or to any coin-freed mechanism, consists of a pair of vertical leaves or plates pivoted together and adapted (when closed) to permit the insertion of the coin between them and, by suitable projections on the insides of the leaves, to arrest the coin in a predetermined position therein. When adapted for taking any of a series of different valued coins, each different kind is arrested in a different predetermined position within the coin-holder. The leaves are adapted to be rotated by the operating handle until one of them is stopped by the engagement of the coin with a stop; the movement of this leaf being communicated to the commodity-controlling means. A further movement of the handle moves the other leaf forward and ejects the coin. The patentee describes and illustrates the arrangement of apparatus applied to an electricity meter.

Gas Lighting Apparatus for Use in Connection with Life-Saving Apparatus.

WILLIAMS, T. E., of Egremont, Cheshire; BERGER, E., of Paddington, W.; and BURROUGHS, J. G., of Southend-on-Sea.

No. 15,191; June 29, 1909.

This invention relates to gas lighting apparatus for use in connection with life-saving apparatus, and for other like purposes wherein a light is required to be given only when the life-saving or other apparatus is automatically released and operated by a sliding weight or other means. Such lighting apparatus is particularly applicable for use in connection with a life-saving buoy as described in patent No. 21,840 of 1907. This life buoy is fitted with a hinged flagstaff, which is normally folded down and held so that it lies snugly against the closed buoy, but is released and raised by a spring or equivalent means when the latter is brought into use and opened. Instead, however, of fitting the upper free end of

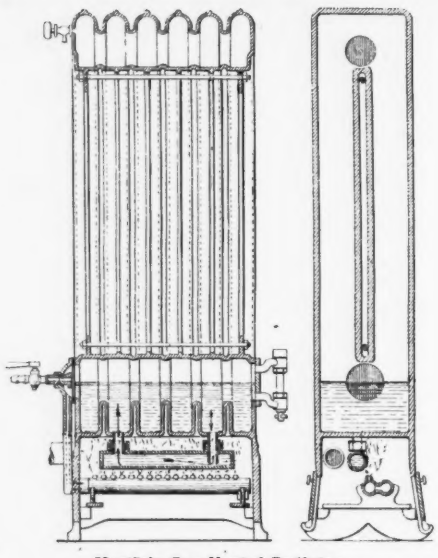
the flagstaff with an electric glow lamp, it is fitted, according to the present invention, with a burner to which two gases, such as phosphoretted hydrogen and acetylene, are supplied, one of which will ignite the other. The supply pipes for the two gases extend down the interior of the flagstaff. Each is connected with a valve plug forming part of the hinge of the flagstaff, and in which the orifices are so arranged that the valves are opened only when the flagstaff is released and raised. The valves are connected by flexible or other pipes with reservoirs containing the gases or materials for generating same; and, consequently, the supply of gas to the burner can only take place when the buoy is in actual use, and will be cut off when the apparatus is closed for storing.

Radiators Heated Directly by Gas.

MARTIN, A., of Revin, France.

No. 28,370; Dec. 4, 1909.

This invention relates to gas-radiators in which the boiler is provided with a thermo-syphon "serving to accelerate the evaporation of the water by increasing its circulation and likewise the heating surface," and it essentially consists in arranging the thermo-syphon in the chamber of the burner above, and laterally of, the rows of gas-jets in such a manner as not to impede the heating of the boiler.



Martin's Gas-Heated Radiator.

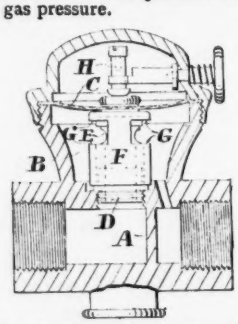
This radiator (as shown) consists, like others of the same type, of elements communicating one with the other at their upper part and forming at their base a boiler, the bottom of which is heated by a row of gas-jets, which the gas reaches after having passed through a valve which automatically regulates its consumption. Beneath the boiler there is arranged a horizontal tube connected with the boiler by two vertical tubes. The assemblage constituted by these three tubes forms the thermo-syphon serving to increase the circulation of the water. It is arranged in the burner chamber in such a manner that it does not prevent the flame of the gas-jets from heating the bottom of the boiler; and it causes a circulation of the water in the direction indicated by the arrows.

Automatic Gas-Regulators.

WILLIAMS, G. A., of Stoke Newington, N.

No. 2017; Jan. 26, 1910.

This invention relates to automatic gas-regulators for use upon domestic or other supplies where the demand, and consequently the pressure, is subject to considerable variation. It refers to devices of the class in which a valve is employed operated by means of a diaphragm exposed upon one side to the pressure of the atmosphere and upon the other to the gas pressure.



Williams's Automatic Gas-Regulator.

In the arrangement shown, the casing of the regulator is provided on one side with an inlet to be connected to the supply, and also with an outlet to the stove. The admission and escape are separated by a partition A; and a chamber B is provided, the axis of which is arranged at a right angle to the axis of the admission and escape. A perforated screw cap for the upper end of the chamber secures the diaphragm C. At the bottom of the chamber is an aperture leading into the admission port, and secured in the aperture by a screw-thread is a tubular body D, closed at its upper end and perforated at E. F indicates a second tubular body, perforated at G, fitting upon, and arranged to slide freely over, the body D. It is closed at its upper end, where provision is made for its attachment to the diaphragm.

The gas, on entering, passes up the centre of the body D, through the apertures, and thence into the chamber B, and finally to the outlet. So long as the pressure does not exceed a certain predetermined amount, it is not sufficient to overcome the weight of the diaphragm and parts connected thereto, and a full passage-way is afforded to the gas. Should, however, the pressure increase, it will act upon the diaphragm sufficiently to raise it, and with it the body F, which thereupon begins to close the apertures E in the body D, "by this means ensuring a regular supply at a constant pressure to the stove."

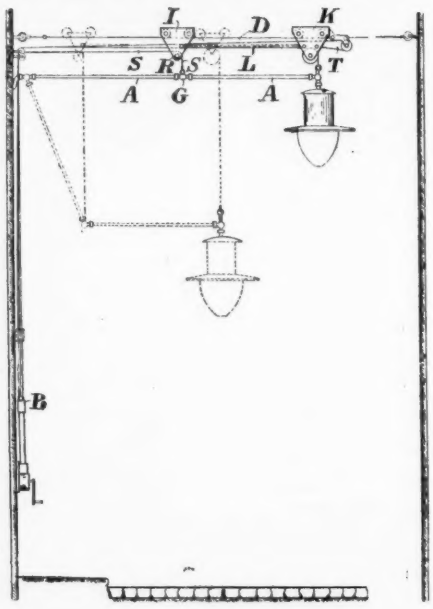
In order, however, to adapt regulators to varying maximum pressures, the resistance of the diaphragm may be increased by means of a weight in the form of a circular body H, having a head at each end, and which is freely supported in an aperture formed in the end of a spindle having a milled head at its outer end in the cap. When the regulator is working under a normal pressure, the spindle is turned until the body of the weight is at right angles to the axis of the spindle. When, however, there is a demand for additional pressure, the spindle is turned so that the lower end of the weight rests upon the head of the extension on the part F, and its weight is added to that of the parts required to be lifted before the supply can be reduced.

Suspending Gas-Lamps at Cross Streets.

DEUTSCHE GASGLÜHLICHT ACTIENGESELLSCHAFT, of Berlin.

No. 1166; Jan. 17, 1910. Date claimed under International Convention, Sept. 2, 1909.

This apparatus, for suspending lamps on supports that cross streets, is of the kind wherein the middle joints of the supply pipes are secured to a rope usually passing over a pulley or roller fixed to a house front in order to prevent sagging; the object being a construction in which the strain at the middle joints is directed upwards vertically (or nearly so) by employing, in addition to the running block which carries the lamp, an auxiliary running block, to which is secured the pulley or roller for the rope carrying the pipe joint.



A Gas-Lamp Lowering Plant.

In the form of construction shown, D is the tension rope, which, as usual, extends across the street from one row of houses to the other, and on which the block K travels. On the tension rope an auxiliary block I is provided, which is connected with the main block by a chain or the like. The auxiliary block carries the pulley or roller R, over which runs the rope S connected with the joint G. If, now, by way of example, the lamp which has been lowered is raised from the position shown in dotted lines by moving the main block K towards the right by the rope T, then the auxiliary block I, connected with the main block by the chain L, will move in the same direction, whereby the joint G, through the rope S, will be pulled upwards. In this operation, the pull on the joint always takes place upwards and in a nearly vertical direction, and the strain on the joint and in the rope is much less than if the direction of the pull is sideways, at an acute angle. The downward pull on the rope coming from the weight of the pipe-joint G and the pipe-limbs A, may be balanced by a counterweight B.

The operation in lowering the lamp is illustrated by the position of the parts shown in dotted lines.

A Reduction at Burton-on-Trent.—The Burton-on-Trent Town Council have agreed to a reduction in the price of gas of 2d. per 1000 cubic feet; making the maximum charge within the borough for ordinary lighting 2s. 4d., and the minimum 2s. 2d.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Battle of the Burners.

SIR,—Not since the memorable battle of the gauges in the railway world has Parliament had a more protracted and exhaustive industrial struggle in hand than the just-concluded "Battle of the Burners."

After the patient—nay, long-suffering—attention given by an exceptionally intelligent and conscientious Committee, over such a protracted inquiry as ten days furnished, the promoters have emerged with the three Bills practically unaltered.

The conspicuous feature of the inquiry in the Commons was the very clear-sighted, searching, and probing investigation by the Chairman of every ramification of the various allegations in opposition, and his thorough grasp of the essential merits of the varied cases involved in the contentions, occasionally rather wide of the promoters. Standing out very markedly was the masterly array of the facts and main issues shown in the convincing speeches of Mr. Honoratus Lloyd. Next to these forces towards victory, must be noted the lucid logical power of Mr. Carpenter's thrice—nay four—told tale, making clear the technicalities surrounding the evolution of his burner, the consequential "advantages" to the manufacturer, and, above all, his insistence, logically advanced and maintained against the fiercest cross-examination from many sides, that such advantages had always in the past, and would ever in the future inure to the benefit of the consumer. For clear demonstration, frank discussion, and earnest conviction, this evidence, even at the wearisome end, and after the most provoking tergiversation in opposition, was unrivalled, though Professor Vivian B. Lewes, and some others, were successful in defending the "faith that was in them."

A regrettable feature of the opposition was the base nature of the suggestions as to how the consumer was to be exploited, and the plunder disposed of by the "wicked directors" and the companies; and when the Chairman blandly inquired what had happened where corporations had changed to the new burner, the witnesses walked into the trap with a most diverting simplicity, failing to see how their admissions undermined the foundations of their attack.

The fight was a bitter one. But the cases for the Bills were well formulated; and here the agent, Mr. Cooper, deserves full recognition. It will prove an expensive fight; and it is to be hoped that those whose circumstances brought on the fiercest and most prolonged attack will bear this in mind when the "bill" comes to be paid.

Palace Chambers, Westminster, S.W., July 18, 1910. HY. E. JONES.

Gasholder Tanks with Bulging Sides.

[TRANSLATION.]

SIR,—In reply to the observations of Mr. Cripps in the last number of the "JOURNAL," permit me to say—

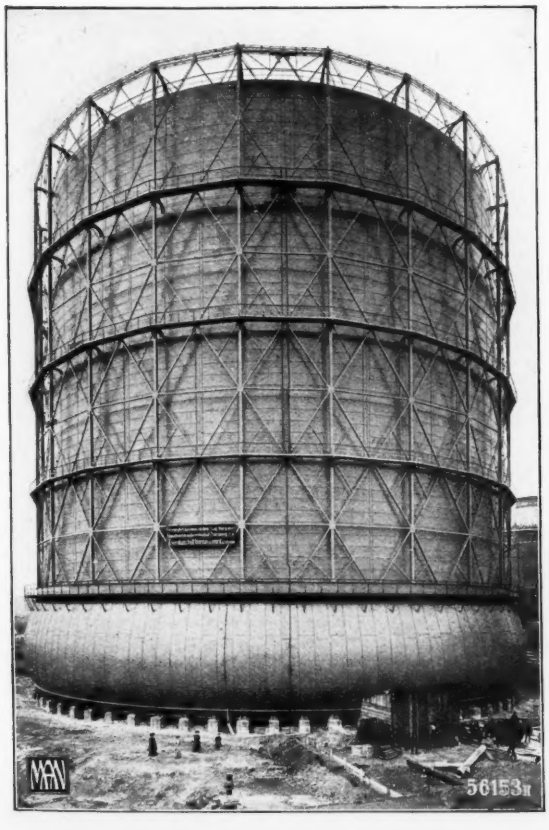
1.—In the example given, the strain following the tangent, at the upper part of the curve, is 62,100 kilos. It is distributed, per metre of length, into a vertical strain of 54,500 kilos, which the vertical posts resist, and a horizontal strain of 30,000 kilos., which the horizontal girder resists.

2.—The vertical posts are 2·83 metres (9ft. 3¼ in.) apart.

3.—The circumferential tension is $\frac{30{,}000 \text{ k.} \times 65 \text{ m.}}{2} = 975{,}000$ kilos., which the horizontal girder has to put in equilibrium. This girder is calculated to work at 10 kilos.

In order to make the curve of the tank more easily seen, we have exaggerated it. In reality, in the construction of the gasholder at Simmering, the tank wall is less curved. The tangent, at the upper point, approaches more nearly the vertical, and the horizontal strain is less than 30,000 kilos., in order not to have too strong a horizontal girder. At Simmering, the girder is of wrought iron, 1·520 metres wide and 18 mm. thick, and four angle-irons 100 × 200 × 14 mm. These dimensions are sufficient for working at 10 kilos., as this girder corresponds to a horizontal strain less than that of 30,000 kilos. indicated on our drawing.

Lyon-Vaise, July 15, 1910. E. BONNET.



In connection with the subject under discussion, it will be of interest to reproduce, from M. Bonnet's paper, read before the Société Technique, which gave rise to it, the accompanying illustration of a holder constructed as described, which we were unable to give in conjunction with the translation [see *ante*, p. 37].

Handling Hot Coke by Electric Telpher.

SIR,—I notice in the paper which Mr. Shoubridge recently read, on "Stoking Machinery and Coke-Handling Plant," that reference is made to the electric telpher; and Mr. Shoubridge is evidently under an impression that the telpher is not efficient when dealing with full charges as delivered by the present-day discharging machine. I beg to suggest, however, that this can hardly be the case, as the telpher would seem specially suitable for dealing with coke under the above conditions.

The writer has had considerable experience of telpherage work, especially as applied to gas-works, and has no knowledge of a case where the telpher has not been capable of handling the coke as fast as the machine can discharge the retorts; although, of course, this to a large extent depends on the actual run that the telpher has to perform to discharge its coke, and the experience of the telpher driver in the handling of his machine.

The telpher can be designed to take practically any load; it is only a question of a sufficiently large motor. Therefore, the actual number of retorts discharged into the skip is, to some extent, optional. The average load handled, in the writer's experience, is about 21 cwt. of actual coke—say, equal to the coke discharged from three retorts; the coke-skip being made of such a size that it will extend over (say) any three retorts at one level. These three retorts are then discharged into the skip by the machine; and, from the writer's experience, the discharging machine will take at least three minutes to discharge the three retorts.

The telpher (having previously placed another skip in position in front of the next three retorts) travels over the full skips; the hoist ropes are attached; and the load is hoisted, and conveyed out of the retort-house, where the skip is lowered into a tank of water to quench the coke. It is immediately hoisted again, and the machine travels to the coke hoppers or heap, and discharges the coke. The telpher then returns with the empty skip; lowers it down on the floor in front of the next retorts to be drawn; the hoist ropes are attached to the loaded skip; and the same cycle of operations is performed.

The average running speed of the mono-rail telpher is about 450 feet per minute; and the hoisting speed 60 feet per minute. Therefore, say the height of hoist inside the house was 30 feet, and the length of run-out to the heap 400 feet and back 400 feet, the time-cycle for the telpher properly handled would be as follows:—

To hook on hoist ropes, say	5	seconds
,, hoist 30 feet, say	30	,,
,, travel 400 feet, say	55	,,
,, tip into hopper or on heap, say	5	,,
,, travel back light, say	52	,,
,, lower empty skip by gravity, say	10	,,
Total for complete run	157	seconds

If the skip is lowered into a tank for quenching, this would take (say) 20 seconds; the tank being at such a height that the minimum distance only has to be hoisted and lowered.

Thus with a long run of 400 feet each way, one telpher should be capable of handling three retorts of coke in three minutes; and if the discharger is actually worked to handle one retort a minute, it is hardly likely to get ahead of the telpher.

With regard to there being a large number of skips required in the house, as mentioned in Mr. Shoubridge's paper, as will be seen from the above, there is no need for more than two skips to be used per telpher, and even then there is practically only one on the floor at the same time.

I notice Mr. Shoubridge refers to a telpher plant in operation at the Linacre South Gas-Works, Liverpool, and is not quite sure if it is worked in conjunction with a large number of retorts worked by stoking machinery. This plant is, however, of such a design that it could practically handle any number of retorts discharged by any number of machines, for the following reason. The actual telpher-track runs right through the house, out at the end, along over the coke store and hoppers parallel to the house, and continues on round into the house at the other end—being a complete circular track. Actually, therefore, any number of electric telphers could travel round this track, one after the other.

There are actually, I believe, 174 retorts in the Linacre house; and they are all discharged by machinery. I am of opinion that if only one discharger is used, one telpher is able to keep pace with the machine, though the run is rather a long one and the hoist considerable. There

are, however, actually two telphers installed on the track; but I believe the two are not used except in cases of great pressure.

From the illustration shown of the house at Lower Sydenham, the actual maximum run from the house to the coke-store would only appear to be (say) 500 feet, and the height required to hoist inside would apparently be only about 12 feet. I am, therefore, of opinion that, even if the discharging machine worked at the rate of one retort a minute in this house, one telpher would handle the coke as quickly as the machine discharged it. The actual average length of run is only 300 feet.

Telpherage is not applicable to all retort-houses, as the conditions vary so; but, under ordinary conditions, a telpher is certainly able to deal with the coke discharged by machinery as fast as the discharger would be likely to work.

With regard to the power required, one telpher handling one-ton loads, hoisting and travelling as stated, will require an average of about 6 H.P., as, although, of course, the maximum horse power used when hoisting is likely to be (say) 12 H.P., the power used when travelling back light is very small. So that the power question for any length of run certainly seems much less in the case of a telpher. And with regard to the question of upkeep and repairs, this is bound to be very low, as the whole of the working parts—*i.e.*, the telpher—is up out of all contact with the coke; the coke skips only being subject to this influence.

PERCY G. BROOKS,
Manager, Handling and Transport Department,
Robert Dempster and Sons, Limited.

Elland, July 11, 1910.

How Gas Consumers are Robbed—Instructive Illustrations.

SIR,—An article headed as above, by W. I. Parker, in "John Bull" of July 9, 1910, starts with quotations from a paper I read before the Yorkshire Junior Gas Association on March 19, 1910, and leads up to the conclusion that, "as matters now stand, meters cannot be described other than as legalized robbery."

While agreeing that there is room for improvement in the Sales of Gas Act, 1859, I showed that, in the majority of cases, the conditions told in favour of the gas consumers.

I gave a series of tests of meters, illustrating that it would be beneficial even to the sellers of gas to advocate an amendment of the Act, and that it was but a common-sense proposal to make the testing conditions as approximate as possible to actual working conditions. From this series, the results of the tests of three meters (tested under conditions most favourable to them) have been quoted to give colour to the article.

Mr. Parker does not mention that my paper also contained the following: "Mr. James Stratford, Gas Meter Inspector for the City of London, in the course of his report for the year ending Dec. 31, 1908, says: 'Of the meters tested for disputed registration, 3083 were found to be correct, while 3527 were wrong; 1304 being fast, and 2223 slow;'" and, while he quotes from the latest report of the same authority, it appears more convenient to say nothing about the meters which were:

	Fast.		Slow.
Over 20 per cent.	4	..	311
Over 10 per cent. and under 20 per cent. .	42	..	554

This, and the concluding part of the report, would have spoilt the "legalized robbery" idea.

For his own purpose, Mr. Parker finds it better to point out the few extreme cases found in the last report of Mr. S. Dyson, the City of Manchester Inspector of Gas-Meters; and then to quote numbers showing the proportion of tested meters that were inaccurate, ignoring the fact that, in the great majority of cases, these are meters picked out, because from their age, exposure, &c., incorrect working is suspected, and finally, by suppression of the facts, to leave the general newspaper reader to infer that all incorrect meters are fast—*i.e.*, going against the consumers' interest.

Mr. Parker evidently has not had much experience of the conditions under which gas-meters work, and has had only one end in view; otherwise he would not have used a portion of my paper to illustrate an article with the above title.

Again, it must be patent to all that, if there were many meters like those he mentions, such items as "leakage" or "unaccounted-for" gas would be unknown to gas concerns.

PETER MCNAB.

Lowmoor, Bradford, July 18, 1910.

The article in "John Bull" contains the following passages:

In all probability, there is no form of weight or measure whose accuracy is open to so much question as that of gas-meters. Yet despite this, it is one that is subjected to the least control. In fact, it is such that it practically amounts to nothing more nor less than legalized robbery, as I will endeavour to prove. Gas-meters are tested for accuracy according to the tests prescribed by the Sale of Gas Act, 1859; such tests being carried out at a pressure of 5-10ths, or ½ inch. When it is remembered that gas is now supplied and consumed at a pressure of from 4 to 6 inches, it will be readily seen that the test imposed is one that is altogether at variance with modern conditions. As an example of how the registration of a meter may be affected by difference of pressure, I will quote the result of tests made at a meeting of the Yorkshire Junior Gas Engineers. Three three-light meters were tested and registered as follows

	1st Meter. Per Cent.		2nd Meter. Per Cent.		3rd Meter. Per Cent.
At 5-10ths pressure registered	2·4 fast	..	1·42 fast	..	correct
,, 25-10ths ,, ,,	3·6 ,,	..	2·6 ,,	..	1 fast
,, 45-10ths ,, ,,	4·1 ,,	..	2·25 ,,	..	2 ,,

Thus showing that, with an increased pressure, they registered against the consumer. Another point in connection with such tests is that, when once a meter has been passed as correct, it is deemed to be so for all time. If the report of the Chief Inspector of Meters for Manchester is noted, it will be found that meters have a great tendency to become inaccurate after they have been in use a few years; for he reports that of the 1449 meters tested for the Corporation, the majority of which belonged to the consumers, 1093 were found to be inaccurate, the meters in question having been in use over ten years. The Chief Inspector of Meters for Manchester points out in his report an anomaly that should be rectified—viz., that the indices of meters were not required to be tested, and that the test authorized simply related to the measurement part of the meter and not the recording. Of the indices tested by him, 56 were condemned; the five most serious errors being as follows:

5-light meter registered	. . . . .	100 per cent.	fast
3 ,, ,, ,,	. . . . .	50 ,,	slow
5 ,, ,, ,,	. . . . .	25 ,,	fast
10 ,, ,, ,,	. . . . .	150 ,,	,,
50 ,, ,, ,,	. . . . .	150 ,,	,,

The first three were meters repaired by makers, while the others were owned by gas consumers. The meters when submitted to the legal test registered correctly according to the test. But, as a matter of fact, they were recording as shown by his figures, thus showing that a meter that has been passed as being accurate may all the while be showing 100 per cent. more, due to a defective index. The Chief Inspector of Meters for the City of London lately made inquiries, and reported that of the 7544 disputed meters tested by him, 5873 were found incorrect. . . . What is more, a form of measure is in use that is subject to no test at all—viz., the prepayment meter attachment; and as such affects the poorer classes more than any other, it is absolutely necessary, if their interests are to be safeguarded, that a change should be made. But as matters now stand, meters cannot be described other than as legalized robbery.

LEGAL INTELLIGENCE.

PROPERTY OWNERS AND WATER CONSUMERS LIABILITY.

At the Wandsworth County Court last Tuesday, His Honour Judge Harington delivered a considered judgment in an action tried before him a month ago. The plaintiff, Mrs. Ivy Bond, an upholsteress, residing in South Wimbledon, claimed from the Wandsworth Borough Council and the Metropolitan Water Board £100 damages for personal injuries sustained by her through the alleged negligence of the defendants in leaving a hole in the pavement in Blackshaw Road, Tooting, in consequence of which she fell and was somewhat severely hurt. It appeared that the lady was passing along the road on the 13th of January last when her foot caught in a hole in the pavement which had been cut by the Council to receive a stopcock and box which had been furnished by the Board for the purpose of giving a supply of water to an adjoining house. The evidence showed that in 1907, the Board, at the request of the owners of the adjoining houses, fitted a service-pipe and apparatus for supplying water to the property. Shortly after this, the Borough Council intimated to the Board that they were about to make up the road, which at that time had not been taken over by the local authority as a highway to be repaired at the expense of the inhabitants at large. The Board were directed to have the water-fittings brought to the necessary level before the pavement was placed in position; and this having been done, workmen on behalf of the Council adjusted the stopcock and box in position.

At the trial, the learned Judge held that there was no liability upon the Council to maintain the stopcock and box in a state of repair; and consequently he dismissed the action against them. Mr. Ross-Brown, for the Water Board, then submitted that his clients were also exempt from liability to repair; and he cited various Statutes and authorities, but particularly the Metropolitan Water Board (Charges) Act, 1907, under which the consumer for whose benefit, and at whose expense, the pipe and service were laid was entitled to open up the pavement for the purpose of repairing a defect. Mr. Justice Phillimore, in the recent action of *Stacey v. Gaslight and Coke Company, Metropolitan Water Board*, and *West-End Tailoring Company* ["JOURNAL," Jan. 18 last, p. 185], had held that section 8 of the Act was retrospective, and applied to old pipes as well as to new.

His HONOUR, in an elaborate judgment, reviewed the authorities and Statutes, and held that the contention of the Water Board was valid. The Board were, in his opinion, relieved from liability by Parliament, who had shifted the responsibility on to the shoulders of unsuspecting private owners who requested the Board to furnish their property with a supply of water. This burden was placed on the ratepayers by a Private Act of Parliament, of which the public were not cognizant; and it should be made as widely known as possible. However, in view of the authorities, he was bound to hold that the Board were entitled to succeed; and he therefore gave judgment in their favour also.

A question arose as to costs; and those of both defendants were ordered to be paid by the plaintiff.

National Air Gas Company, Limited.

On Monday last week, Mr. Justice Parker was asked *ex parte* to appoint a Receiver of the undertaking of the above-named Company. Counsel on behalf of Mr. Crewdson, the plaintiff, said his client was holder of certain debentures issued by the Company in 1909, which became due on the 1st of January last, but had not been paid; and the interest due in July was also in arrear. The urgency for the application arose from the fact that creditors had obtained judgment, and one had seized the chattels of the Company; in addition to which the landlord had put in a distress. His Lordship appointed a Receiver over the following Friday. On that day, Mr. Romer, K.C., informed his Lordship that it had been arranged that the motion should stand over for a week, and that the Receiver should be continued and also be appointed Manager. As there were several important contracts to be completed, it would be necessary that the Receiver should be authorized to borrow, to pay wages. The Company not objecting, his Lordship gave leave to borrow a sum not exceeding £200.

At the meeting of the Tiverton Town Council on Monday last week, the Lighting Committee recommended that the Gas Manager (Mr. Clark Jeffery) be paid £75 as remuneration for extra services in superintending various alterations at the gas-works. It was pointed out that £13,000 had been laid out in connection with the gas undertaking during Mr. Jeffery's management, and all had proved remunerative. He had also saved the town a good deal of money by drawing up specifications, &c. The recommendation was adopted.

THE SCIENCE OF GAS-HEATED WATER SUPPLY.

No. 2.—The Experience that gives Authority.

Last week we laid down certain principles. We did so in an authoritative tone. Why have we done so and committed our reputation deliberately to these principles? Because we are familiar with the subject, not as theorists only, but as having the long and varied experience of successful work that entitles us to speak with authority. Our position as Makers of leading Gas Water Heaters is well known. The standing of our Eagle Range Works as Experts in Water Heating is equally weighty. They have had unrivalled experience of the effects of various Waters and Water Heaters of different shapes and different materials. Several men who are to-day leading Authorities, Inventors, and Writers, in Water-Heating Science have had their experience and training in one or other ot our Works.

We value our prestige and authority in these respects so highly that—

We never condemn a principle or a method or an apparatus because it is not ours, but because it is not correct.

We never commit ourselves to an authoritative statement on such matters without knowing it to be an incontrovertible scientific truth.

We refuse to make or recommend any Apparatus because others make or sell it, when we know it to be scientifically unsound.

We will only make and offer Apparatus constructed on principles which science and experience fully justify.

We know the principle of the "SUN" Boiler is the right one, and its success has justified our steady avoidance of small interspaces, gills, capsule thermostats, and other unscientific methods.

The "SUN" Boiler.

JOHN WRIGHT & CO.,
The Gas Water-Heating Authorities,
Essex Works, BIRMINGHAM.

COAL TAR PRODUCTS.

Benzol, Toluol, Solvent Naphtha, Creosote Oils, Grease Oils, Carbolic Acid, Dark Cresylic Acid, Granulated (Crude) and Sublimed Naphthalene, Anthracene, Refined Tar and Pitch. Sulphate of Ammonia up to 20·75 per cent. Nitrogen.

For Prices apply to the **SOUTH METROPOLITAN GAS COMPANY**

Works: ORDNANCE WHARF, EAST GREENWICH, LONDON, S.E.

709, OLD KENT ROAD, LONDON, S.E.

Telegraphic Address: "METROGAS, LONDON."

NOTICE.

Full Particulars regarding the MERRIFIELD-WESTCOTT-PEARSON Water Gas Plants may be had on application to the Patentees at

19, ABINGDON STREET, WESTMINSTER, S.W.

R. LAIDLAW & SON (EDINBURGH), LTD.

GAS METER MAKERS.

STATION METERS

IN

Ornamental Square & Round Cast-Iron Cases.

ALL SIZES.

Drawings, Specifications, and Prices on Application.

SIMON SQUARE WORKS,
EDINBURGH,
AND
6, LITTLE BUSH LANE,
LONDON, E.C.

LATEST DESIGN.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills read a second time and committed: Fylde Water Board Bill, Water Provisional Order Bill.

Bills reported, with amendments: Gas Orders Confirmation Bills (Nos. 1 and 3), Mountain Ash Water Bill, Pontypridd and Rhondda Joint Water Board Bill, Rhondda Urban District Council Bill, Shirebrook and District Gas Bill, Slough Water Bill, South Hants Water Bill.

Bills read the third time and passed: Gas Orders Confirmation Bills (Nos. 1 and 3), Glasgow Gas Consolidation Bill, Mallow Urban District Gas Bill, South Hants Water Bill, Water Orders Confirmation Bill.

The Water Provisional Order Bill, against which a petition has been presented by the Kingswood Water Company, has been referred to a Select Committee, consisting of Lord Clinton (Chairman), Lord Langford, Lord Colchester, Lord Shute, and Lorth Blythe; to meet to-day.

A Bill to confirm a Provisional Order relating to Clydebank and District Water has been presented, read the first time, deemed to have been read a second time, pursuant to the Private Legislation (Scotland) Act, 1899, and reported.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: Gas Orders Confirmation Bills (Nos. 1 and 3), Water Orders Confirmation Bill.

Bills reported: Havant Gas Bill [Lords], Middleton Corporation Bill.

Bills read the third time and passed: Great Grimsby Gas Bill [Lords], Montrose Water, &c., Order Confirmation Bill, South Lincolnshire Water Bill [Lords].

MR. ISAAC CARR'S TEST-BURNER DIAGRAM.

At the sitting of the Committee on the Standard Burner Bills last Wednesday, the publication in the "JOURNAL" of the comparative test diagram prepared by Mr. Isaac Carr received prominence by an objection raised by the Hon. J. D. Fitzgerald to the inclusion in the diagram of the figures connected by dotted line, showing, as a foot-note stated, "the observations by Mr. Carr, at the offices of the London County Council, 40, Craven Street, Strand, on the 7th inst." The special case of Liverpool was proceeding; and the Hon. J. D. Fitzgerald was examining Mr. Carr. Learned Counsel, producing a copy of the "JOURNAL" opened at the page on which the diagram appeared, asked witness if he was responsible for it; and Mr. Carr readily replied in the affirmative. The following discussion ensued:

Mr. FITZGERALD: I would like the Committee to see that. It is something which appears in the "GAS JOURNAL."

Mr. TALBOT: If something is to be handed in, the opponents are entitled to see it.

Mr. FITZGERALD: If you will allow me, I will make the point; and then you can see it.

The CHAIRMAN: You will allow Mr. Talbot to see it.

Mr. FITZGERALD: Here is the diagram.

Mr. TALBOT: That is what I want to see. [The paper was handed to learned Counsel.]

Witness: It is a copy of the diagram on the wall.

The CHAIRMAN: We are familiar with that.

Mr. FITZGERALD (to witness): It is a print of that diagram there?

Witness: Yes, with some addition.

Supplied by you to the "GAS JOURNAL"?—Yes.

You added to it something which is said to have happened on July 7?—Yes.

What is that?—My own observations.

Do you mean when you were present with the members of the Committee?—Yes.

Mr. FITZGERALD: The members of the Committee will know if any tests were taken on that day. You will see this gentleman has put an addition to the diagram and suggested something was done when you visited the London County Council station, and that the dotted line which is added represents something done on that occasion.

The CHAIRMAN: As I said before, we do not look upon that as a test, and did not ask for a test to be made. It was admitted all round that a test was not made.

Mr. FITZGERALD: This is published in the paper as something that occurred in your presence at the testing-station.

Witness: This is my observation. I observed the gas. The No. 1 burner was screwed on to the photometer. The flow was adjusted to 5 feet. The operator for the London County Council read out the illuminating power as 10·4.

The CHAIRMAN: He did.

Witness: And then after the burner was taken off, the No. 2 burner was screwed on. The first observation when the burner was cold was read out by the County Council observer as 13·9, after the current had been regulated. I pointed out then it was necessary before an observation could be taken with this burner that the burner must be allowed to burn a time to get heated, in order for the regenerative effect in the base of the burner to take place. While the Committee were departing from the room, the illuminating power was increasing all the time; and I directed the attention of one of the members of the Committee to it just as he was going out of the room, and said: "The observation now has risen to 15." I know I asked the tester the quality of gas that was being distributed in that district by the Gas Company that day, and he said it was about 15 candles. So that there was the difference from the observation that I made at the station of 4·6 candles between the two burners.

Mr. FITZGERALD: You know, Sir, what happened at the station.

The CHAIRMAN: Yes.

Re-examined by Mr. TALBOT: I understand you have put upon that diagram what you yourself saw on the occasion when the Honourable Members of the Committee saw the test?

Witness: That is so. I had not seen it before.

The CHAIRMAN: It is common to both sides that there is a difference. I distinctly said at that time: "We cannot take this as proof of what the difference is." We did not go there for that purpose; and I do not think it was made under conditions which altogether can be accepted as proof.

Mr. TALBOT: I quite understand that, Sir. All I want to know is this. I understand my learned friend put this diagram in, in this dramatic manner, suggesting some misconduct on the part of Mr. Carr. I only want to know if you are satisfied with what he has said and done.

The CHAIRMAN: Yes.

Mr. FITZGERALD: Mr. Carr ought not to have suggested that any test took place when the Members of the Committee were present, because I am informed that nothing of the sort took place.

Witness: May I explain? I had not seen the paper before. If they have copied a marginal note I put on the diagram and handed to the "GAS JOURNAL," they will know I did not put it as a test. I said these were my observations made on that day. So they were not proper tests; and I have never set them forth as proper tests. They were my observations just as I could pick them up, during the explanation of the apparatus, in the way I have explained.

The CHAIRMAN: We did not understand Mr. Carr as pretending at the time that it was an actual testing figure.

Witness: I stated in the marginal note to the diagram what actually took place.

Mr. TALBOT: May I respectfully call your attention to what you, Sir, said before the Committee went there, because that was the origin of the misunderstanding? No doubt it was not what you intended; but you will see how we unfortunately misunderstood what you said. We understood the Committee wished to see a test taken in their presence.

The CHAIRMAN: Did I say that?

Mr. TALBOT; You will find that if you look at page 202 of the minutes; and you will see how we misunderstood. I do not in the least complain, but only wish to explain it.

The CHAIRMAN: Perhaps I did say I wanted to see how a test was operated—that is, the *modus operandi* of a test, not resulting figures.

Mr. TALBOT: Please understand I do not in the least complain of what you have done—it would not become me to do so if I thought there was ground for it. But there is no ground for it.

The CHAIRMAN: I quite understand.

Mr. TALBOT: May I read it? These are the words you are reported to have used, Sir: "I spoke yesterday about the Committee going to see a testing of the gas with one expert on each side; and I believe it has been arranged to-day." I quite understand what was in your mind. You merely wanted to see how a test was taken. We, unfortunately, thought you meant you wished to see the burners compared in your presence. You see how the misunderstanding arose.

The CHAIRMAN: Yes; I do. Perhaps I am responsible for it. I ought to have negatived it.

HAVANT GAS BILL.

The Bill promoted by the Havant Gas Company for the purpose of conferring statutory powers on them came up for further consideration by the Unopposed Bills Committee of the House of Commons on Thursday last—having been put back for a fortnight to enable some alteration to be made in its financial provisions.

Mr. BAKER (Parliamentary Agent) explained that the consideration of the Bill had been adjourned by reason of the Company issuing fresh capital during the progress of the measure through the House. The necessary alterations had now been made in the Bill. The Company had issued £1500 of 7 per cent. capital, and obtained a premium on it of £766. This capital had been dealt with, and the clause in the Bill altered and made to apply not only to the moneys raised under the Act, but also under the Provisional Order of 1879; and they were only to be applied for capital purposes. With regard to the standard price, this had already been fixed by Parliament at 5s. by the Provisional Order of 1879; and the Company for years past had been entitled to pay a dividend of 13 per cent., because they were only charging 4s., instead of the standard price of 5s. But they had not exercised this privilege, and had only paid 10 per cent. They were quite prepared now to reduce the standard price from 5s. to 4s.; and the Bill had been altered in this form.

Mr. MOON (Speaker's Counsel): We are not cutting down the dividend by cutting down the price, because they have never paid more than the standard dividend.

Mr. BAKER agreed.

Formal evidence proving the preamble was then given; and the Bill passed and was ordered for third reading.

Middlesbrough Corporation Bill.—This Bill, which proposes to confer further powers upon the Middlesbrough Corporation with respect to the supply of gas and electricity, and for other purposes, came yesterday (Monday) before Lord Balfour of Burleigh, acting in the capacity of Lord Chairman of Committees. The Bill was ordered to await report pending certain minor amendments.

THE LIVERPOOL GAS COMPANY AND THE BURNER BILL.

The Proceedings on the Separate Case.

Friday, July 8.

In this case, the opposition came from the Liverpool Corporation and the Waterloo with Seaforth, Litherland, Great Crosby, and Allerton Urban District Councils, who were represented by Mr. RAM, K.C., Mr. TALBOT, K.C., and Mr. COURTHOPE MUNROE; the Bootle Corporation, represented by Mr. RAM, Mr. TALBOT, and Mr. MUNROE; and the Mersey Docks and Harbour Board, for whom Mr. BALFOUR BROWNE, K.C., and Mr. G. J. TALBOT, K.C., appeared.

Opening Speech by Mr. Honoratus Lloyd.

Mr. HONORATUS LLOYD, in opening, said he thought the case was covered by every observation he had already made; but there were certain additional observations he wished to make upon the special features of the case. In 1848, the Liverpool Gas Company were under obligation to supply 16-candle gas. In those days, there was an idea that a high illuminating power was of greater value; and so it was. But gas was not then used for motive power to the extent it was now, nor for incandescent lighting. But in 1865, the power was raised to 20 candles; and from that time to the present moment the Company had been under obligation to supply 20-candle gas. This had been measured by the flat-flame burner. In this case, the proposal was the same—to substitute the No. 2 burner which was being asked for by the other companies in the No. 1 Bill. It so happened that when they got up to high candle power gas, there was considerably less difference between the one and the other burner than there was with the lower candle power. The saving was therefore not as great in the manufacture, although it was considerable. It was said by the opponents that the change ought not to be allowed; and if the change was allowed, that some *quid pro quo* should be given. They were all agreed that the change ought to be made in the other cases; and the question was whether it should be made in Liverpool. In 1895, there was a certain amount of incandescent lighting in Liverpool; but it had not come to the enormous preponderating point that it had now. In 1895, the Lighting Committee of the Liverpool Corporation passed a resolution, which they sent to the Company. The resolution was as follows:

> That, having regard to the development in the methods of manufacturing gas and the improvements in gas-burners which have been made since the Gas Company's Act of 1865 was passed when the illuminating power of the gas was fixed at 20 candles, and the experience gained since that date, the Directors of the Company be requested to consider whether the standard candle power of the gas could be reduced in the interests of the consumer; and if so, whether it would be in the interests of the Company that parliamentary sanction should be obtained to lower the candle power so as to enable the Company to supply gas at a lower price than at present, and that the Directors be asked to confer with the Committee on the subject.

So that the Corporation foresaw this position before they did. He mentioned this because his other opponents, the Mersey Docks Board, cried out when it was suggested that the candle power would come down with the change of test-burner. They said it was monstrous that there should be this alteration. So enamoured were they of a lower grade gas and a cheaper gas, that last year their Engineer actually threatened the Company that if they could not see their way to reduce the price of the gas they were contemplating providing gas for themselves. So that fifteen years ago they had the Liverpool Corporation desiring a reduction in candle power, and the Mersey Docks Board saying that they proposed themselves to adopt a lower grade gas. Yet they were both now crying out when the Company were seeking to establish the accurate burner which had the effect to a slight extent of reducing the candle power and enabling them both to get cheap gas. Liverpool were a maximum-price Company, paying their maximum dividend, and their reserve fund was full. Therefore the only outlet for the profit that was made was by a reduction of the price of gas. Under their Act, it was provided that all surplus profits should go in reduction of the price.

Under these circumstances, what were the differentiating items between Liverpool and the other case? Liverpool had expressed its desire for a lower candle power gas and obtaining cheaper gas, both of which they would get under the Bill. The proposed burner (No. 2) was not suitable for testing the Liverpool so-called 20-candle power gas at the rate of 5 cubic feet per hour, because the flame tailed-up beyond the chimney, and they were not able to deal with it satisfactorily. But when it tailed-up over the chimney, they were to reduce the flame by getting the greatest amount of light. Therefore, in the Bill, there was a provision specially for Liverpool—that where the gas tailed above the chimney, it should be dealt with in this way.

With regard to the Mersey Docks and Harbour Board, in the other House there were witnesses called who told a most terrible story of what was going to happen to the gas-engines; and Mr. Carr told the Committee that if the gas-engine to-day was being worked up to its maximum power, with a reduction of the calorific value, the engines would have to be scrapped. But, of course, if an engine was being used to-day right up to its maximum power, inasmuch as the calorific value of the present gas varied considerably from day to day, it followed that the engine would be in a very awkward position, because it was incapable of dealing with any margin on account of the variation. As a matter of fact, it was not so. Another witness in the other House, Mr. Newbigging, said that if such gas were supplied to the Mersey Docks the result would be that their engines might have to be scrapped. The opposition, however, called Professor Burstall to support them; and he said, "That is nonsense what Mr. Carr and Mr. Newbigging have been telling you. As a matter of fact, we prefer a lower grade gas for gas-engines; and by means of an adjustment of valves, or, if the pipes happen to be too small, enlarging the pipes, the gas-engines will be all right." The promoters would now call before the Committee a gentleman who had expert knowledge of these matters; and he substantially agreed with what Professor Burstall said on that occasion. The differences that existed in Liverpool were, if anything, in favour of the promoters. They could measure the gas perfectly accurately with the new burner; and they would be able to provide a cheaper gas, which was what had been asked for. The candle power would incidentally be reduced; and in so doing, all the saving must automatically go to the consumer, inasmuch as they were a maximum-price Company paying their maximum dividend.

Mr. Charles Carpenter's Evidence.

The first witness called in support of the promoters' case was

Mr. *Charles Carpenter*, the Chairman of the South Metropolitan Gas Company. He said Liverpool was the only one of the 43 companies in the Bill that supplied 20-candle power gas. His burner was capable of accurately measuring the gas; but in the process of gas supply it was not possible, when the test was made with a flat-flame burner, to keep quite accurately at the 20-candle line. It was very often 21 and 22 candles. In the case of the extra richness of the gas under these circumstances, it would require that the consumption of the gas in the burner should be somewhat reduced. His burner was not designed for the purpose of 20-candle gas. It was designed particularly to carry out the recommendations of Lord Rosse's Committees; but they had tested it up to 20-candle gas, and it was found to give accurate results. There was the provision in clause 5 that if the gas was so rich that it could not be burnt with a full air supply and at the prescribed rate of consumption without tailing above the chimney, the rate of consumption should be reduced until the flame burnt properly within the chimney. This met the case if the gas were so rich as to cause the flame to tail. This proviso was extracted from the "Notification" of the Gas Referees current in the present year, which described the process exactly—the consumption was to be reduced to bring it within the limits of the burner. With his burner, the true illuminating power of the gas would be accurately recorded. Taking the Liverpool gas as it was at present supplied, the difference shown would be from 1½ to 2 candles; but if gas was supplied enriched with benzol instead of with carburetted water gas, there would be practically no difference—he was sorry to use the word "practically"—between the indication given by the present flat-flame burner and the No. 2 "Metropolitan" argand. In South London, they had something like 2000 gas-engines at work. The largest set of these belonged to the London County Council, and were used for pumping the storm water from the streets into the River Thames. There was a large installation at the Surrey Commercial Docks; and gas-engines were used for a great number of other purposes. During the last seven or eight years, they had reduced the illuminating power of their gas from 16 to 14 candles, and had adopted the standard burner; but they had received no complaint at all from gas-engine users.

In reply to Mr. BALFOUR BROWNE, witness agreed that he was not connected with the Liverpool Gas Company; but he said he had had exceptional facilities for following the working of the Company. In the Liverpool Act, it was provided that: "All gas supplied by the Company shall be of the best and purest quality, and shall, in respect of its illuminating power, at a distance as near as may be 1000 yards from the works, be such as to produce from a batswing or fishtail burner consuming 5 cubic feet of gas per hour a light equal in intensity to the light produced by 20 sperm candles of six to the pound, each burning 120 grains in an hour." He agreed that this bargain between the consumer and the Company had been confirmed on two separate occasions. The bargain was made in the year 1865, and was confirmed in 1882 and 1886. He thought it was right that the Company should be allowed to change it.

Mr. BALFOUR BROWNE: Supposing the Mersey Docks and Harbour Board had come and said: "Notwithstanding this bargain, Parliament ought to put a clause upon the Company making them deliver 25-candle gas as tested in that way," would you not have said it was unfair?

Witness: Yes; but may I put it in another way? Supposing such a bargain did exist by which the Company had to supply gas of 20-candle power measured in this appliance. Supposing the Company come before Parliament and say: "We can supply the same thing with greater advantage to the consumer if you will allow us to measure it in an instrument which is more accurate."

We have nothing to do with accurate instruments?—It is perfectly possible to supply the parliamentary requirements of Liverpool with a gas which is carburetted with benzol. If gas is carburetted with benzol, it will give a return in the flat-flame burner comparable with what the No. 2 argand will give; but it will give a return which is more capable of reproduction in the argand burner than in the flat-flame. In other words, of identical gas you have a much more accurate method of measuring it in the case of the No. 2 argand than in this old imperfect appliance.

I am not on the question of accuracy of test. That is not what Parliament said. Parliament said you are to give these 20 candles tested by the flat-flame burner?—Certainly; in those days.

CHAIRMAN: Accurate or not accurate.

Mr. BALFOUR BROWNE: Accurate or not accurate. Supposing the flat-flame burner absolutely destroys half the value of the gas, then you have to make gas of double the quality that you would otherwise have tested with that burner?

Witness: Yes; only that is not the case in Liverpool, because, with the new burner, it may be that under certain circumstances exactly the same value as, and under other circumstances gas of a little lower illuminating power than, is made with the flat-flame test-burner would be shown.

If it is exactly the same, what is the use of the Bill?—Because it is not always exactly the same. If you carburet with benzol, it is the same.

London is in an entirely different position to Liverpool, because we have not got the No. 1 burner. We have got the fishtail or batswing burner, and you propose to substitute something for this?—Yes; it is different in name, but not in fact.

Replying to further questions, witness agreed, generally speaking, with what he said in the other House when he admitted that by the new burner they could give to the consumer gas of less high quality and candle power than he was getting before, and that would give him in some cases something less in the way of light and heat than he had before. If the consumer were to have the same amount of light and heat he had before, he would have to burn more gas to get it.

Mr. BALFOUR BROWNE remarked that the disadvantage of having taken this case separately was that the promoters were not going to

call Mr. Corbet Woodall. He could not now cross-examine him. He then proceeded to quote extracts from the evidence given by Mr. Woodall in the other House: "(Q) Suppose you were testing a gas which showed on the London No. 1 burner 20-candle power, like Liverpool, by testing it through the 'Metropolitan' No. 2 you would expect to find some difference?—(A) I think I would rather not answer a question about that. I know nothing about the testing of those gases with these burners. But certainly the No. 1 argand burner would be quite unsuitable for testing 20-candle gas." "(Q) Would you regard the flat-flame standard No. 7 (that is, the test at Liverpool) as being an unsuitable burner to test 20-candle gas?—(A) No; I should think probably it would be a good one." "(Q) I put it to you that if you test 20-candle power gas (result shown, 14·7), shown on the flat-flame, it would show on the 'Metropolitan' No. 2 20-candle power—that is, 6-candle power difference?—(A) It may be so; but I do not know it, and I should be very much surprised if such a result took place." "(Q) Would you grant that there is a difference in all cases in the results—in the case of high-grade gas a small difference, and in the case of low-grade gas a big difference?—(A) Yes."

Witness thought he could accept every word of that evidence.

Mr. BALFOUR BROWNE: Do you know that the argand No. 2 was put upon London by the Referees because they thought they were bound to do it by the Act of Parliament?

Witness: Of course, they were bound to do it. They were fulfilling the duties for which they were appointed by Parliament.

The object of the clause in the Liverpool Act is not to ascertain the illuminating power, but to test the illuminating power of gas by the flat-flame burner?—Yes.

Now you want to put upon me something else and say: "It is not accurate; I want to have an accurate test." Then you must pay for that?—If you will eliminate from consideration the fact that by far the largest proportion of the gas used for illuminating purposes is used in an incandescent burner—if you will eliminate incandescent burners because they are for the present a disturbing factor, and assume that the whole of the gas would be used apart from an incandescent burner, the burner which the public would use would be an argand burner, as they did all over London before incandescent burners were invented. There is nothing whatever to prevent the Liverpool people going on testing with a flat-flame burner for information purposes, exactly in the same way as is done in London. The Liverpool Company were exceptionally situated with regard to the obtaining of richer coal than was available for London, and that is one of the reasons why the quality of Liverpool gas, and therefore the use of the flat-flame burner for testing it, was maintained for so many years.

And can easily be maintained now?—If the use of cannel were not an antiquated, extravagant, and obsolete manner of making gas.

Replying to further questions by Mr. BALFOUR BROWNE, witness said it was quite true that the price of cannel was not so high as it was in 1886; but it was still an unsuitable coal for the manufacture of gas. His Company had reduced the illuminating power from 16 to 14 candles, and they gave the public 2d. per 1000 cubic feet. Sir George Livesey said that was twice as much as they ought to have given; but it was a sacrifice the pioneer in anything had to make. In the case of Liverpool, the adoption of the No. 2 burner might reduce the illuminating power of the gas; but there were a great many arguments why the Liverpool Company should not give the consumers what his Company had given. In the first place, London ought not to have had it. They did not have it for the use of the burner; they had it because Parliament altered the bargain in reducing the candle power from 16 to 14 candles. So far as he had been able to ascertain, there was no connection between illuminating power and calorific value.

Mr. BALFOUR BROWNE: Do you mean to say that a 20-candle gas tested in this way in Liverpool is not a better calorific agent than a gas of the same illuminating power tested by the No. 2 burner?

Witness: Not necessarily. You may have a gas which shows 20 candles in the No. 2 burner, and a gas which shows 20 candles in the flat-flame burner; and it might be that their calorific value was the same.

By this method of testing, will there be a reduction of probably 15 per cent. in the calorific value?—No; I should not say anything like that quantity under the worst circumstances. I think 5 or 6 per cent. would be the very outside in the extreme cases, and in some instances there would be a gain.

With this reduction of calorific value, you would be substituting for cannel coal gas, coal gas mixed with carburetted water gas?—You might do so.

With a mixture of these two, what percentage of carburetted water gas would you give under circumstances of giving this less calorific value?—There is no direct relationship between the two.

Calorific value is of some use to people who consume gas for heating, cooking, or motive power?—Yes.

And yet you propose in the worst conditions (we say it is far more) to reduce this by 5 or 6 per cent. without altering the price of your gas?—That is 5 or 6 per cent. in the laboratory test. If you used these two qualities for cooking your dinner or boiling your kettle, you would not be able to tell the difference the one from the other.

I am perfectly certain if you reduced it by 5 or 6 per cent. it would not cook so quickly?—There is really not that difference, because supposing the calorific value is 500 B.Th.U., for the sake of argument, only a fourth or a fifth of the calorific value is used; so that you bring down your 5 or 6 per cent. to a very small figure.

If in the laboratory you find 6 per cent., in the house you say the 6 per cent. does not count?—In the house you do not utilize it at all. You have not the scientific instruments for using the whole of the heating quality of the gas. In the laboratory, the scientific instruments absorb the whole of it.

Cross-examined by Mr. Talbot: Do you say the No. 2 argand is suitable for testing gas of 20-candle power?

Witness: With the proviso that in case the flame tails above the chimney, you reduce the consumption and correct it in the manner provided by the Gas Referees.

Supposing you burn the Liverpool gas, which now shows 20 candles in the flat-flame burner, what would it show in the No. 2?—It might be 20, or 21½, or 22 candles.

But there is no difficulty in applying the parliamentary test which has been applied ever since the year 1865 in Liverpool?—The difficulty has been that you could take half-a-dozen burners of this kind and get a difference of probably 4 candles in the results they give. You might have a gas showing anything from 18 to 22 candles.

And you propose a burner that would enhance the gas by 2 candles?—Under some circumstances; but in other circumstances, it would give the result the flat-flame burner would give.

Witness agreed that nearly three years ago he wrote to the Superintendent of Street Lighting at Liverpool: "In reply to your letter, I beg to say the No. 2 'Metropolitan' argand was not designed to burn such a quality of gas as is supplied to the Liverpool Corporation. Such qualities are rare, and becoming rarer; and for that the air supply is too restricted. I could have designed such a burner; but my object in the present production was to make such a one as would give uniformity of testing to the London gas supply and, *inter alia*, many others without departing too much from the previous existing patterns."

Mr. TALBOT: Your burner was not designed to test such a supply as Liverpool?

Witness: Yes; it was not designed to burn the quality of gas such as is supplied by the Liverpool Company—that is, between 20 and 21 candles.

Taking a gas that shows 20 candles in the argand No. 2, what would that show in the flat-flame Liverpool burner?—It might show 20—the same thing. I suppose it might show probably 3½ candles more.

Re-examined by Mr. FITZGERALD, witness said the Liverpool Company used to have to bring thousands of tons of cannel from Australia in order to comply with their antiquated requirements. This could not be in the interests of the consumer. It only resulted in keeping up the price. The competition which gas companies had to meet nowadays was more effective than all the Acts of Parliament to keep them in order. But in the present condition of the manufacture of gas, the No. 2 argand was the more accurate burner for testing 20-candle gas. If they were to take four flat-flame burners, the results obtained with 20-candle gas might vary to the extent of 4 candles; but if they were to take four dozen No. 2 argands, and put them all on a float or a pipe, and light them all up at once, they would get exactly the same results from each. The gas supplied by various companies was sometimes tested by friendly and sometimes by unfriendly authorities; and it was important to eliminate the disturbing factor of inaccuracy as much as possible.

Mr. Edward Allen's Evidence.

The next witness to be heard was

Mr. *Edward Allen*, the Engineer to the Liverpool Gas Company. He said Liverpool was a maximum-price Company; and for some time they had been paying maximum dividends. Any additional profits made must necessarily go towards a reduction of the price of gas. He described the present test-burner as indefinite and not accurate for the testing of the gas. He had purchased a dozen of the burners, and found, as the result of tests, that there was a variation of fully 4 candles. It might be that on some days they were fulfilling their statutory requirements, and others they were not. In 1865, the batswing burner was in use at his works. But in 1871, this was changed for the steatite batswing; and it showed the gas to be 2 candles better than the previous burner. He had been experimenting with the No. 2 burner for about four years, and found the results given by it were somewhat higher than those given by the flat-flame burner, which they were now using. The difference varied from 1 to 2½ candles. He then made experiments extending from February, 1908, to April last; and they showed that the average increase obtained by using the standard burner—the new burner—was 1·94 candles. Gas showing 20 candles in the batswing showed nearly 22 candles in the standard burner. With gas made from coal and cannel, the illuminating power in the batswing was 17·99 candles; and in the standard burner it was 20·46 candles. Since the Bill had been before the other House, experiments had been conducted with gas made from coal and cannel and mixed with carburetted water gas. Probably 100 tons of material was used, and the gas was made in the ordinary way. The No. 7 batswing showed with that gas 18·54 candles, and the standard burner 19·79 candles. With coal containing no cannel and a mixture of carburetted water gas, the batswing showed 17·37 candles, and the standard burner 18·95 candles. The experiments made on gas of lower candle power were altogether misleading. He had made many tests during the past 2½ years dealing with nearly 2000 tons of coal. They were samples sent from 25 collieries; and he conducted tests in order to show what could be done with a lower quality of gas. In the No. 7 batswing, the illuminating power was 16·13 candles; in the No. 1 argand, 14·3 candles; and in the standard burner, 17·82 candles. The reduction of 2 candles which had been mentioned would affect only the flat-flame consumers; and that class was fast disappearing, and should, wherever possible, be replaced by the incandescent burner which gave a sevenfold light. In conjunction with gas of a high candle power, a man changing from a flat-flame burner to an incandescent burner used much less gas for the same amount of light. By the proposed change, the calorific value of the gas would not be appreciably affected. At the present time, gas was only judged by its illuminating value. With regard to calorific value, the maximum was 7 above, and the minimum 2½ below, the average. They had exceptional gas of high quality; and it tested most nearly at 665 B.Th.U., and a little above that. For the purposes of this Bill, experiments were made at one of their works with various lots of gas made to suit the conditions if the new burner were adopted; and they found the averages of the illuminating power and calorific value were: Illuminating power, batswing burner, 17·94, the standard burner, 19·90; calorific value, 660·85 B.Th.U. gross, 597·55 B.Th.U. net. As a result of 124 tests, they found figures of 665·90 gross and 605·61 net—giving a difference of 5·05 B.Th.U. gross and 8·06 B.Th.U. net; the percentage of deficiency being 0·75, ¾ per cent. gross and 1⅓ per cent. net. The user of a gas-engine would only experience a difference of 1⅓ per cent. From his experience in connection with a number of gas undertakings, there had been no increased sale consequent upon the adoption of the No. 2 burner. In Liverpool, the adoption of the burner would be a distinct advantage to the consumers. He did not wish to say that there would be as great an efficiency in a gas-engine per foot of gas were the new burner to be introduced in place of the old one,

or, in other words, where there would be a reduction of the calorific value, there would not be the same efficiency per cubic foot of gas used if the calorific value were reduced. He was of opinion that the gas-engines would be as efficient and as capable of doing the work required from them as before. They would be as capable of doing the duty they were doing to-day with the present gas. With gas of a less calorific value, it would mean more gas. As regarded the efficiency of the gas per cubic foot, it would be less; but as regarded the power of the engine, leaving out the word "efficiency," the new gas would be more suitable and more satisfactory. They would have to admit more gas to get the same result. In comparing high-quality gas with low-quality gas, a higher-quality gas in an unsuitable burner would give less efficiency than a low-quality gas in a suitable burner. With a lower-grade gas, the incandescent mantle was of greater durability. They failed to get perfect combustion of the gas in the incandescent burner; and there was carbon deposited on the mantle. Where a manufacturer had prepared a burner specially suitable for 14 or 16 candle gas, they could not get the same duty from that as from a burner specially prepared for 20-candle gas. In this sense the Liverpool consumers were handicapped. High-pressure gas lighting was coming rapidly to the front; and by its means, very great efficiency was effected. The duty had risen as high as 60 candles per cubic foot of gas used. In this system, rich gas was unnecessary, because, when placed under pressure, the heavy hydrocarbons were liquified and lost. With the 20-candle standard, they had to enrich the coal gas they made to the extent of about 6 candles; and by the adoption of the proposed burner, there would be a saving in the process. Cannel was becoming scarce, and they were driven to enrich with carburetted water gas or benzol. They considered that ¾d. per candle was the cost of enrichment by cannel, ⅜d. by carburetted water gas, and ⅜d. with benzol. But benzol had increased in price; and enrichment by this means was unsuitable, because it did not carry. The consumers were therefore not getting what they paid for. There was no testing-station at Liverpool; the tests being taken at various places by arrangement. The Mersey Docks and Harbour Board were important customers of the Company; the average sum paid by them for gas during the last three years being £17,375. This amount did not include the sum paid by the tenants of the Dock Estate, which would probably be about £11,000. Only 9 per cent. of the burners used by them were flat-flame. Last year, the Engineer of the Dock Board approached him with regard to the amount paid by them for gas, and said that, unless a reduction could be made, he would have to recommend his Board to provide a producer gas plant and dispense with the town gas. As to their gas-engines, the Company had had no complaint of the gas supplied; and his opinion was that the new burner would be to their advantage.

Tuesday, July 12.

In cross-examination by Mr. TALBOT, witness agreed that the object of the Bill was to enable the Company to supply gas of a lower illuminating power than they were at present bound to give. The proposal to change the burner was not merely the machinery to that end, because they well knew that the batswing burner did not do even justice to the various gases that they made. One object they had in view was to be able to compare their gas with that supplied by other towns.

Mr. TALBOT: Supposing you had to keep up the same illuminating power of the gas manufactured, would you think it worth while to get the powers sought in the Bill?

Witness: I am not so sure. The matter has not been considered.

Supposing the Committee thought that while allowing you to change the burner you yet had to supply gas of the same illuminating power as hitherto, would you consider it worth while to have the Bill?—If the matter were put in that way to my Directors, they might possibly not think it worth their while.

Supposing the Committee considered that the illuminating power of the gas should not be diminished, would you still think the change in the burner a valuable one?—I would like to consider that.

Replying to further questions, witness agreed that he was formerly a strong advocate of the higher power gas; but he did not make up his mind with regard to the matter till 18 months ago. He was converted at a meeting at Manchester where he found himself in the minority, and where Mr. Newbigging brought forward facts to show that the reduction of illuminating power would not affect the light. The consumers, of course, had a special interest in this matter; but he agreed that when he made his experiments he did not invite the co-operation of the Corporation or the Docks and Harbour Board. There was no gas so closely tested as in Liverpool; and they were able to keep up to their statutory requirements. It did not follow that because a particular burner or a particular quality of gas was good for one place that it would be good for another. In one town it might be desirable to use a cheap coal, while in another the coal might be much more costly. There were many circumstances to be taken into account.

Mr. TALBOT then put to witness a number of quotations from the "JOURNAL OF GAS LIGHTING" of February, 1907, which represented his opinions at the time; and he agreed that 20-candle gas at 2s. 6d. per 1000 cubic feet was cheaper than 16-candle gas at 2s. 4d. With regard to a number of tests he then made with a Welsbach burner, and in connection with which he stated that the effect on the mantle when the gases were changed was very pronounced, he now said the whole of these experiments were vitiated by the fact that he attempted to make the best possible use of one burner only. Subsequently he attempted to use other burners, and got other results. By altering the burners, it was possible to get an infinite variety of results; but he had learnt something since then. His opinion now was that the value of the gas in the incandescent burner depended upon its calorific value. He agreed that when he made the experiments in 1907 he said that the inevitable conclusion to be drawn was that a reduction in the illuminating power would be detrimental to the interests of the consumer when the gas was used for lighting, whether in a flat-flame or an incandescent burner.

Mr. TALBOT: With the flat-flame burner, a reduction in the illuminating power would be detrimental to the interests of consumers?

Witness: I am not prepared to say what would happen if I used other gas.

Replying further to Mr. TALBOT, witness agreed that in 1907 his opinion was that with regard to a reduction in light in the flat-flame and incandescent burners, the calorific and illuminating power bore very close relation to each other.

The CHAIRMAN: What you are trying to prove, Mr. Talbot, is that the gas which would be supplied if the Bill passed would be of lower quality than that which is supplied now?

Mr. TALBOT: That is admitted. But the other side say: "It will be of a lower quality; but it is to the advantage of the consumer that it should be." What I am putting to witness is that in 1906 he said it would be detrimental to the consumer to get a worse light.

The CHAIRMAN: The broad fact is admitted that there would be a difference in the gas.

Mr. TALBOT: If the Committee think it is proved that there will be a difference in the gas, and that difference not only gives the consumer a worse light but costs more money, I will not say another word.

The CHAIRMAN: The whole issue is really a simple one, and that is as to what was the intention of Parliament with regard to the meaning of the words used in the former Acts to carry out the intention.

Mr. TALBOT: But there is a difference with regard to Liverpool. Take, for example, the Hastings case. There is no dispute that the requirements of Hastings are perfectly explicit—it must be 15-candle gas in the No. 1 burner. When the promoters put their case, they said: "It is quite true that is a definite prescription which can be applied; but the No. 1 argand was adopted because the Referees in London had selected that burner under an Act which required them to prescribe a burner which did most justice to the gas." They say the Referees prescribed this No. 1 burner as complying with this requirement, and that was put in the provincial Acts. But that has nothing whatever to do with Liverpool. We have never had a No. 1 burner. Our burner has been prescribed ever since 1863—five years before the City of London Act was passed. There is a perfectly clear and specific requirement in Liverpool—the gas is to be such as in a batswing burner gives a light equivalent to 20 candles. This is the bargain in Liverpool as between the Company and the gas consumers. It was fixed before the City of London Gas Act, and has nothing to do with the No. 1 burner, or the Referees, or anything. It is admitted that the effect of this Bill, by changing the burner, is to enable the Company to distribute a lower illuminating power of gas. All I want to get from Mr. Allen on these experiments, and with that burner, is that the change must be detrimental to the consumer, both in respect of light, heat, and money.

The CHAIRMAN: It seems to me the principle is the same in the Hastings case as in the Liverpool case.

Mr. TALBOT: There is no colour in Liverpool for suggesting that the Liverpool test-burner was adopted on the principle of what is called doing justice to the gas.

The CHAIRMAN: The candle power was fixed in both; and the candle light was well understood in both. We are told by a very eminent scientific authority that there is no such thing as a scientific candle; but there is such a thing, and a well-understood thing, as a candle. The fact is common to both cases, Liverpool and Hastings—that Parliament prescribed a light equal in density to so many prescribed candles. You are going to differentiate between them by saying in Liverpool they began with a different kind of burner, and therefore perhaps it is more damaging in that case. Professor Frankland himself said: "There is no such thing as a scientific candle."

Mr. TALBOT said that the question was not of candles, but whether with a standard of gas testing with a photometer they were able to say: "There is gas of 15 or 20 candle power." His case was that this entirely depended, first of all, upon the burner in which the gas was burnt, and, secondly, upon the rate at which it was burnt.

The CHAIRMAN: Your position is that it is the burner which is the cardinal point?

Mr. TALBOT: Yes. He said there were two cardinal factors; one was the light of the candles, and the other was the burner in which they had to burn the gas, and according to which the gas showed a different light. There was no dispute about that. On the other side, it was admitted that, by changing the burner, the illuminating power of the gas they were bound to supply would be changed also. The question was as to whether the change was disadvantageous to the consumer in light and in heat and in money, and the witness admitted it was so if the consumer were to burn the gas in the flat-flame burner or the particular Welsbach burner which had been mentioned.

Witness said he was willing to admit that the change would involve a difference of 2 candles; but he would not admit the difference would be 4 candles. The expression in their Act was indefinite—"batswing or fishtail."

The CHAIRMAN: Did you, in order to supply a 20-candle power light through whatever burner you used, have to force through it gas which, tested in the No. 2 burner, would have shown more?

Witness: Yes.

Mr. TALBOT: Yes, of course, Sir, that is our case.

Witness said that through the first burner they had to pass very much more gas.

Mr. TALBOT: They are going to supply a gas which will be much lower than 20 candles illuminating power.

The CHAIRMAN: But in the No. 2 burner, as I understand it, that really represents so many candles light; whereas under the previous burners it would not represent what was the real candle light prescribed.

Mr. TALBOT: I cannot make it clearer. To my mind, that is giving the go-bye to our whole case.

The CHAIRMAN: I think it is very convincing.

Mr. TALBOT: Our whole case is that there is no such thing as 20-candle gas; and what Parliament has told the Liverpool Company to do is to supply gas which, in a certain burner, gives a light of 20 candles. If you alter the burner, it will enable them to give a gas which, in the existing statutory burner, would only show 17 or 16 candles, and thereby you reduce the illuminating power of the gas by at least 3½ candles.

The CHAIRMAN: But they do not produce the prescribed amount of light.

Mr. TALBOT said they could hardly conceive that Parliament would be evaded by so transparent a process as this. If the promoters had

come to Parliament for a reduction in the prescribed illuminating power, there would have been some allowance made as compensation; but because they were achieving the same result in a different way, they were to give nothing.

Witness said his experience was that in some cases the alteration would be to the advantage of the flat-flame burner.

Mr. HARVEY: May I take it that, under certain conditions, this lower candle power gas, burnt in an incandescent burner, would be worse for the consumer?

Witness: It might be; it depends upon the calorific value of the gas. In some cases there is a lower illuminating power and a higher calorific value.

Mr. BALFOUR BROWNE then proceeded to cross-examine witness on behalf of the Mersey Docks and Harbour Board. He said, with regard to the tests he had made, that the results obtained from the No. 7 batswing and the standard burner varied. In one test, the batswing gave 13·16 candles, the No. 1 burner 14·93, and the standard burner 17 82. This was with low-grade gas. He agreed that by the adoption of the No. 2 burner they would be able to work more economically; and he saw no reason at all why the saving should not go to the consumer. When the South Metropolitan Company reduced their illuminating power by 2 candles, there was an allowance of 2d. That Company worked under the sliding-scale. In the case of Liverpool, every penny that was saved must go to the consumer. Asked whether the saving might not be applied in the increasing of the salaries of their servants, witness said that the Directors would not be affected in the slightest in that respect. The salaries of their servants would not be increased unless there were good reasons for doing it. The Company's accounts were very closely audited.

Mr. BALFOUR BROWNE: And you have been making expensive experiments to the extent of using 2000 tons of coal. Might not those experiments deprive the consumers of any reduction?

Witness: That is so.

On the other hand, if you reduce your price in the Act equal to the reduction of illuminating power, it would be fair, would it not?—There is no necessity whatever for it.

It is a prudent thing to spend money out of revenue that might be spent out of capital?—We do not do it.

But you might if you got a large sum in hand?—It would be impossible, because the Recorder's Auditor carefully examines our accounts, and we are prevented from doing anything of that sort.

Would the new test deprive us of any of the calorific value that we get to-day?—I am of opinion that it would not, or very slightly.

By a lower calorific value of gas, I have to use more to get the same result?—That would be so; but it would not apply to Liverpool.

With regard to the gas engines of the Dock Board, witness said they would not have to abandon their engines altogether in consequence of the proposed change of burner. The Company's proposal was not to injure their consumers, but to benefit them.

In re-examination by Mr. PADDON, witness said that the Mersey Docks and Harbour Board had asked the Company for a reduction in the price of gas, and had intimated that if they did not get a reduction they might have to provide power gas for themselves. The calorific value of producer gas was 150 B.Th.U., and that supplied by the Company was 660 B.Th.U. The normal change in the average calorific value from day to day was 9½ per cent. over the year. They had strong electrical opposition in Liverpool; and the Company's object was to sell their gas as cheaply as they could, so as to compete with electricity. On the other side of the Dock estate, they were receiving a supply from two other gas companies of 14-candle power. In the experiments which had been referred to, he used a Welsbach burner, which was required to handle gases of 16 and 20 candle power. Apart from illuminating power, the uniformity that was aimed at in the Bill was a very important consideration. The change the Company proposed to make had been made in the case of other companies where the candle power varied from 14, 15, and 16 candles; and he had heard of no inconvenience or disadvantage resulting from it.

The CHAIRMAN: Have you made any calculation as to what the amount of the saving would be as a result of adopting the No. 2 burner?

Witness: It would be 1d. The difference would be 2 candles at ½d. per candle per 1000 cubic feet. The saving would all of it go to the consumer.

Captain Sankey's Evidence.

Evidence was then given with regard to the effect of the reduction upon gas-engines by

Captain *Sankey*, who said the power obtained from gas-engines depended upon two main qualities—the calorific value, and the amount of air mixed with the gas in order to produce an explosive mixture. He believed that calorific power had no definite relation to luminosity. With Mond gas the calorific power was 140 B.Th.U., and with town gas 660 maximum and 500 minimum. There was practically no difference in the value of the proposed and the existing gas for gas-engine purposes. If there was a difference at all, it would be in favour of the gas the Company were proposing to supply. If the change of burner meant a reduction in candle power from 20 to 18, his opinion was that it would make no practical difference to its use in gas-engines. As a rule, if the calorific value went down, so also the amount of air would go down, and *vice versâ*. Therefore he would not expect to find any difference in the two gases. The percentage of difference was very small. In the normal working, the difference amounted to 5 per cent., which was due to various losses, and might be *plus* or *minus;* but such a variation would not necessitate the scrapping of a gas-engine. The change in burner would have a tendency to cheapen gas, which would be all in the interests of gas-engine users generally, without sacrificing any efficiency. He could not see that the interests of the Harbour Board would be affected in any way. With regard to gas-engines, an explosion could not be produced unless there was a mixture of some air; five or six times the amount of air had to be introduced. The air that was necessary depended upon the quality of the gas. As a general rule, there was a relation between calorific value and luminosity; but there were exceptions. The higher the luminosity, the more the calorific power. It was usual to have the pipes of the gas-engine suitable to the particular engine; but as to whether it was a question of having the tubes the smaller the better, he did not think it made very much difference. He would certainly differentiate between the pipes used for Liverpool gas and producer gas, because in the case of Liverpool about 16 or 17 cubic feet of gas per hour would be required; whereas with producer gas from 80 to 100 feet would be necessary.

Mr. BALFOUR BROWNE: We are going to try and convince the Committee that the calorific value of the gas would be reduced by 15 per cent. Supposing that is so, do you mean to tell the Committee that the power of the engine is not reduced?—

Witness: I say it would not be reduced.

In reply to further questions, he said that, although there would be a lower calorific value, there would be no loss of power. It was not conceivable to him that the pipes of a gas-engine would be affected by the change of the burner.

Mr. Samuel Glover's Evidence.

Mr. *Samuel Glover*, the Gas Engineer to the St. Helens Corporation, said he had made comparative experiments with different grades of gas. With the No. 7 batswing he had obtained 14·31 candles, and with the standard burner 18·92 candles, and showing 554·13 B.Th.U. He had also experimented in order to obtain a gas of 20 candles in the standard burner; and he found that, in the No. 7 batswing, gas showed 18·34 candles and a calorific value of 580·45 B.Th.U. He had also experimented to get a gas of 19-candle power in the standard burner; and this was found in the No. 7 burner to differ by only 1·62 candles. In that case, the calorific value was 587·01. With regard to Liverpool, his opinion was that, with the new burner, the consumers would get a gas that would be more useful for all purposes. He did not think it would affect the use of gas-engines. The flat-flame burner was not applicable to low-quality gas. It was in this way that such extraordinarily sensational results were obtained. It had been suggested to him that the different results were obtained by the manipulation of a mixture of gases; but all gas was a mixture of gases, and differences in composition must occur. The No. 2 burner would accurately measure these differences, and enable them to bring about scientific comparisons.

Professor Vivian B. Lewes's Evidence.

Professor *Vivian B. Lewes* then gave evidence. Replying to Mr. PADDON, who asked if he thought that the change between the No. 7 flat-flame burner and the No. 2 burner, as confined to the case of Liverpool, would make any ascertainable difference to the users of gas-engines, witness said that unless the fact were widely advertised not a single consumer would be aware of it. He saw no reason to differentiate between Liverpool and the other cases.

In answer to Mr. BALFOUR BROWNE, witness said the No. 2 burner was suitable for testing any gas. In the case of Liverpool, the loss to the consumer would be 1½ candles. He had not made experiments with the Liverpool gas; but there was no reason why it should not follow the general rule. Some experiments were absolutely useless in a case of this kind. It was work that was done year in and year out. "You will get with the No. 2 burner," he said, "results which are far better, and of far more importance, than with any other burner." With gases between 18 and 20 candle power, better results would be shown; and with 20-candle gas the difference would be from 1½ to 2 candles. The new burner would give results which could be relied upon. It would give from 1½ to 2 candles better results than the batswing burner.

In reply to Mr. RAM, witness said he gave evidence on the Dublin Gas Bill, where the proposal was to reduce the illuminating power from 16 to 14, and substitute the No. 2 argand for the flat-flame burner. The standard price was reduced from 4s. 1d. to 3s. 10d.; and there was a reduction of candle power. A good many witnesses had already said that the flat-flame burner was absolutely improper for testing gas of 16 or 17 candle power. They were making a half-way house with the bunsen burner; and by taking the flat-flame they were depreciating the light which was given. The Dublin Company had the flat-flame burner; and the result was that they had to give 18-candle gas to develop 16 candles in the flat-flame burner. They asked to be freed from this; and there was a reduction in the illuminating power. In that case he believed there was some *quid pro quo*.

Mr. RAM: There was a reduction of 3d. But apart from that, if the Company get an advantage the consumers ought to have something given to them relatively?

Witness: Yes; they must do so.

Do you think they ought to?—I think they ought, because Parliament has made it essential that they should. I am referring to the sliding-scale and maximum-price companies.

Apart from that, is it right, and has the practice of Parliament been, to make allowance?—I do not remember an allowance being made for the change of burner except in the Brighton and Hove Bill.

Re-examined by Mr. PADDON, witness said that when the Liverpool Company were given their present burner, it was found that the quality of the gas was raised by 2 candles, showing exactly the same principle that was brought forward now. The burner used should be the one that would give the best results. It was certainly not the intention of Parliament to give the maximum amount of light in London and not the maximum amount of light in the Provinces. The enormous differences which had been shown were absolutely of no importance. He could make a gas which would show a difference of some 6 candles by making it in a way which would never be employed practically. But with the Liverpool gas, as the Liverpool Company made it, they would get a difference of about 1½ candles. But with a good, honestly-made gas, these differences could not exist; and the No. 2 burner would show the illuminating power accurately, notwithstanding its composition. The burner could not show any illuminating power unless it was there.

This closed the case for the promoters; and it was agreed that Mr Ram should proceed with the case for the Liverpool Corporation. Mr. Balfour Browne was, however, permitted to interpose a witness on behalf of the Mersey Docks and Harbour Board.

Mr. A. G. Lyster's Evidence.

Mr. *A. G. Lyster*, Engineer to the Mersey Docks and Harbour Board, said it would be detrimental to their interests if the Bill were allowed

to proceed in its present form. They used a considerable quantity of gas; the total amount on an average per year being 185 million cubic feet for lighting and heating, and nearly 42 millions for power purposes. Their lighting account amounted to £23,189, and for power £5226. The Company would be able to give gas of an inferior quality; and in respect of this they, as consumers, were to get nothing. The burner proposed was merely for testing purposes, and would show 20 candles; but if the gas were burnt in flat-flame burners, it would not show nearly this illuminating power. They would have to spend more money and pay a greater amount for the gas, and they would have to alter their burners and method of lighting. Their total candle power would be reduced by 15 per cent. In order to get the same efficiency, they would have to burn a larger amount of gas; and they would be put to very considerable expense. Capital outlay would be required in connection with their gas-engines, of £5600. It would be practically impossible to use a greater amount of gas of lower calorific power in their existing engines. The proposed gas would not enable their engines to perform their duty if they were now working at their maximum. Four of their gas-engines had cost £17,000. He had analyzed the total cost of consumption, and estimated that for all purposes it would cost them £5200 a year more. The test that ought to be applied should be what the gas would show when burnt in flat-flame burners. The Harbour Board wanted to pay for what they were supplied with, and not for what the Gas Company tested. It was necessary that they should have flat-flame burners, because in a great number of places it was not possible to use the incandescent light. Dust was created in connection with the traffic of the shipyard; and this settled on the mantles, with the result that they were destroyed. The benefit that might accrue to consumers would not compensate them for the loss they would sustain.

Wednesday, July 13.

The Case for the Opposition.

When the Committee met this morning

Mr. HONORATUS LLOYD drew attention to the point which had been raised by Mr. Ram, with regard to the withdrawal of the opposition in the cases of Ipswich and Ilford. When the matter was first referred to, he was not in a position to state what the facts were; but now they had been ascertained, and he thought the Committee ought to know what they were. Both the Ilford and Ipswich Companies found that they were in a position to reduce the actual selling price of the gas by 1d. per 1000 cubic feet at a certain time; and the Local Authorities had therefore decided not to oppose the Bill.

Professor Frankland's Evidence.

Evidence was then given by

Professor *Frankland*. In reply to Mr. Talbot, he said the substitution of a lower-grade gas for a higher-grade gas must be detrimental to the consumer, whether he used it for lighting or heating. He would get a worse article as the result of the proposed change; and it would cost him more. There was no meaning attaching to the phase "so many candle power;" it all depended upon the burner in which the gas was burnt, and the rate at which it was consumed. If an Act of Parliament contained an obligation upon a company to supply gas of 20-candle power and nothing more, it would have no meaning at all. They must prescribe the candle power, the burner, and the rate of flow.

The CHAIRMAN: But the light from 20 candles would not alter?

Witness: Twenty candles is a specified amount; but I could get that light by one gas or another according to the method employed.

Mr. TALBOT: The whole criterion of the obligation on the Company to supply gas is the burner and the rate of flow?

Witness: Yes.

In Liverpool, if you were to substitute for their burner another one, you would alter the whole thing, and alter the gas which the Company are bound to supply?—Yes; absolutely.

Continuing, witness said that each constituent of the gas produced its effect in the flat-flame burner, and each constituent of the gas produced its effect in the No. 2 burner. But in the latter, there were factors which enhanced the amount of light. In the flat-flame burner there was no regenerator principle, and the conditions were altogether different. It was not that the flat-flame burner allowed something to pass without registering it, but that the No. 2 burner enhanced the illuminating value of the gas.

The CHAIRMAN: On the other side, they say that more gas is passed through the No. 1 burner than the No. 1 registers.

Mr. HONORATUS LLOYD: Mr. Newbigging said in his evidence that the No. 1 burner registered so much gas; but there was something which passed on to the consumer which the burner failed to show.

Witness said that the same gas passed through the No. 1 and the No. 2 burners would produce more light in the latter, because it was consumed under different conditions. It produced the regenerator principle, which led to a better result.

The CHAIRMAN: What Mr. Carpenter said was that more gas, and gas which cost them something more to make, has to go through the imperfect register in order to get it to register 14 candles.

Mr. TALBOT: We agree to this extent: They must pay more in order to get a higher illuminating power. The No. 2 burner enhances the value of the gas.

The CHAIRMAN: But the light remains a constant factor. They say that, in order to get the instrument to give 14 candles, they have to pass gas through which is really 15 or 16 candle power.

Mr. TALBOT: Professor Frankland is explaining that there is no such thing. When once you get this fact, that the same gas with a different burner shows 10, 12, 13, 14, 15, 16, 20, and 22 candle power, how can you say there is such a thing as 12-candle power or 18-candle power? (To witness:) And there is no finality in the No. 2 burner? There are others out of which you can get more candle power still?

Witness: Yes.

The CHAIRMAN: You deny what the other side allege as a fact, that very much more gas has to be passed through the instrument in order to get a return of 14 candles?

Witness said that in order to get 20 candles out of the flat-flame burner they had to supply more expensive gas than if they got 20 candles by means of the No. 2 burner.

The CHAIRMAN: You admit that by the No. 2 burner they would still be able to comply with the parliamentary demand of 20 candles without going to the expense?

Witness: They would be setting the parliamentary standard at naught, because the Liverpool standard is that the gas there must be burnt in their particular burner.

Replying to Mr. TALBOT, witness said he considered the flat-flame burner was the proper test for Liverpool gas. Mr. Corbet Woodall had said the same thing. The Liverpool Act said they should supply gas of 20 candles in a particular burner at a particular rate. If Parliament had meant that the gas should show the same light in the No. 2 burner, the nominal illuminating power would have been greater. The effect of this Bill would be that the gas supplied would be, or might be, changed to the disadvantage of the consumer. He attached importance to the test-burner being one that the consumer could understand and reproduce in his own house.

With regard to the relation of illuminating power to calorific value, witness pointed out that when he gave evidence before the other House he said that the diminution of illuminating power by one candle was attended by a diminution in the calorific value of 3·1 per cent. He had since examined the reports of the London County Council, and in the case of the South Metropolitan Company, he had set out the averages for each week at each of their stations. In each case there was a diminution in the heating power when the illuminating power went down; and the average for the loss of one candle worked out at 2·9 calories.

Mr. HARVEY: Would it be possible for a company, if they were going to drop their candle power by two candles, to maintain the calorific value of the gas —That would depend on the manufacturing of their gas before.

In reply to the CHAIRMAN, witness said that a diminished candle power gave a diminished calorific power. He had made experiments with low-quality gas at the works of the Liverpool Corporation, and with a gas of 14·7 candles in the No. 7 batswing, he obtained 19·1 candles in the "Metropolitan" No. 2 burner. There was a difference of 5 candles.

The CHAIRMAN: Then, in order to show a 20-candle registered luminosity, they have to supply 24 to 25 candles?

Witness: I have also examined the Liverpool gas as now supplied. In the No. 7 batswing burner it gave an illuminating power of 21·1 candles; in the No. 2 "Metropolitan" argand the same gas gave 22·8 —a difference of 1·7 candles. This is a much richer gas; and the "Metropolitan" argand in that case does not show the greatly enhanced value as in dealing with lower-grade gas.

Mr. TALBOT: A gas which would show 20 candles in the No. 2 burner would show about 15 candles in the flat-flame?

Witness: It would be about that.

Continuing, witness said that all gas purveyors had to allow a certain margin. They always supplied gas a little richer than the parliamentary requirements. The Liverpool gas had a calorific power of 667 B.Th.U.; and the difference between what they would supply under the Bill and the gas they were now supplying, was that the flat-flame consumer would have a loss of 25 per cent. The loss in heating and motive power would be 15 per cent. The loss in calorific power would be 3 per cent. per candle. With regard to incandescent burners, there would be a loss of 8 per cent. in light. The flat-flame consumer would lose 7·5d. per 1000 cubic feet, the incandescent consumer 2·5d., and the user of gas for heating and motive power 4·5d.

In cross-examination by Mr. HONORATUS LLOYD, witness admitted that, when he put in the results with regard to the South Metropolitan Company, he was aware that theirs was a straight coal gas, and of a totally different composition to the Liverpool gas. The Liverpool gas was coal gas with a certain amount of carburetted water gas. He admitted that the difference of composition made all the difference in the relation of calorific value to illuminating power. Practically, only one-third of the amount of calorific value in the gas was capable of use in gas-engines.

Mr. HONORATUS LLOYD: I am trying to find out the loss. If the loss is 3·1 per cent. for one candle, and as a fact only one-third of it is capable of use, the result is the *loss* of one-third of the 3·1, is it not?

Witness: It would be one-third of whatever calorific power you put in; but the other two-thirds have got to be there.

I asked you on the 6th of July (a week ago) whether you had any fault to find with the proposed burner, and you said "No." Is that still true?—Yes.

And if the consumer in Liverpool gets the benefit, can you see any objection whatever to our proposal?—In some cases he cannot get the benefit.

Mr. HONORATUS LLOYD then read extracts from witness's previous evidence, and asked him whether he agreed: "I do not believe that any very serious injury would be done by lowering the candle power of the gas in Liverpool, provided it is lowered on proper terms. The lowering of the candle power would enable the Gas Company to effect a very considerable saving in the process of manufacture. The consumer would have to use more gas to obtain the results he is obtaining to-day; and I say if the consumer in the case of Liverpool were to have a reduction in the price of gas, I see no reason why the No. 2 burner should not be substituted for the No. 7 batswing"?

Witness: Yes; if you give an equivalent in money. But you cannot.

Do you know that the result of this is that whatever saving there is must go to the consumer?—But there will not be as much saving as he loses.

Your point is that, financially, he loses more than he can save?—He loses more than he can afford to give.

The CHAIRMAN: We want to deal fairly between the maker and the consumer; and we agree that the light should be equal to the light of 15 candles. Which burner would you recommend Parliament to prescribe? We will fix the price and the light, and the point at which the test is to be made?

Witness: If you wish the consumer to have 15-candle gas, and he produces that light himself, I should prescribe the flat-flame burner.

Mr. FITZGERALD pointed out that the question was answered in the Model Clause, where the test to be applied was the "Metropolitan" argand No. 2.

The CHAIRMAN: We want to insist on the consumer being supplied

with 15-candle gas at a certain price, and measured at a certain place. Under these terms, what would you advise us to use if our desire is to show most accurately what the real value of the light is?

Witness: If it is 15 candles in the flat-flame burner, its equivalent in the No. 2 burner is 20 candles; so that your desire to give 15-candle gas in Liverpool would be met in that way.

Mr. FITZGERALD: Have you ever seen that put into an Act?

Witness: No.

The CHAIRMAN: You will keep in your mind the question of price and light which we have reserved to ourselves. I ask you as a scientific expert which is the burner to test the gas accurately?

Witness: If the consumer is to receive 15 candles, then it must measure 15 candles in the flat-flame burner.

Mr. HARVEY: The No. 2 burner is said to be preferable because it operates more accurately over a wider range, and that it is advantageous on the ground that uniformity all over the country would be advisable. On these grounds, would you recommend the No. 2 burner?

Witness: Yes; but not with 15-candle power.

Mr. TALBOT: It would be quite possible to apply the No. 2 burner all over the country; but in cases where there is an existing parliamentary obligation to supply gas of so many candle power, you would require to make a corresponding adjustment in candle power?

Witness: If you wish to give 15-candle gas which the consumer will be able actually to produce, then I say he must have the 15 candles in the flat-flame burner, or, with the equivalent in the No. 2 burner, it would be 20 candles.

And in Liverpool if you wanted to secure gas which would show 20-candle power with the new burner, you would have to raise the nominal illuminating power to secure the same gas?—Yes, certainly. The nominal illuminating power would have to be varied according to the variation in the burner.

Mr. Isaac Carr's Evidence.

Evidence was next given by

Mr. *Isaac Carr*, who said that a small portion of Liverpool was supplied with gas by the Corporation. He referred to an application by the Corporation to the Board of Trade with regard to illuminating power, and said that an Order was granted providing for 20-candle power. That was granted after long discussion, because the Board of Trade proposed that the candle power should be 14. If they were to measure their 20-candle gas by the No. 2 burner, it would give a result of 15 candles; and they would be paying 2s. 6d. for what was worth 1s. 10½d. He had made experiments with regard to calorific power, and found that there would be a loss of 3 per cent. per candle—15 per cent. altogether. In that case, they would be paying 2s. 6d. instead of 2s. 1½d. He had also made experiments to see what the 15-candle gas could be produced for; and he found that it would be 4¾d. less. He calculated that the saving to the Company would be 3¾d. per 1000 cubic feet; and taking last year's gas consumption in Liverpool and multiplying by 3¾d., there would be a saving of £68,000 per annum. Only in the case of the incandescent burner would that represent the loss to the consumer.

Mr. FITZGERALD: If the saving to the Company is £68,000, it would go back to the consumer, would it not?

Witness: It should do so.

Your point is that if the whole saving is given to the consumer, nevertheless he would be worse off?—I say it would compensate the incandescent burner consumer, but not the flat-flame consumer.

This question was raised in the Southport case, where they asked for the standard burner. You pointed out to the Board of Trade Inspector that it would make a very large difference in the illuminating power of the gas; but the Board still granted the standard burner?—The Board of Trade Inspector did not understand the matter at all.

The Board of Trade do not understand it; and you have already said that Parliament did not understand it. We are reduced to this—that there is only one person who does understand it?—Oh, no!

Replying to further questions, he said he was the adviser of the Liverpool Corporation. In raising their illuminating power to 20 candles they used cannel and benzol. He agreed that he had said on another occasion that if the consumers were met by a reduction in the price of gas, he saw no reason why the No. 2 "Metropolitan" burner should not be substituted for the No. 7 batswing.

Mr. FITZGERALD: At the Corporation gas-works they produce gas enriched with cannel and benzol of an illuminating power of 20 candles, as tested at their testing-place; but the calorific value is immensely lower than that of the gas supplied by the Liverpool Gas Company?

Witness: I say that the gas is precisely of the same quality.

Do you mean to say that gas enriched with benzol and gas enriched with carburetted water gas produce the same calorific value?—The calorific value varies with the method of enrichment.

Witness went on to say that he had carried out a series of tests at the Liverpool Corporation gas-works with 20-candle gas used with the No. 2 burner and enriched with cannel and benzol, and he obtained the result of 680 B.Th.U.; with 21·1-candle gas, he got 708. The 20-candle gas was that supplied to the consumer; and, by arrangement, a lower quality of gas was supplied to enable tests as to the cost of production to be made. It was then found that the effect upon the incandescent mantle consumers throughout the district was most noticeable. He had heard Mr. Carpenter's evidence with regard to the change in burner as applied to the South Metropolitan Company, and that there had been no complaints from the users of gas-engines; but he would say if that was the case the engines were not working at maximum power. With the No. 2 burner, the flat-flame consumer would have to burn 25 per cent. more gas in order to get the same amount of light that he was getting now with the No. 7 flat-flame burner. The loss would amount to 7½d. per 1000 feet; and the same applied to the user of gas for motive power. He put down the saving to the Company at 3¾d., and the loss to the motive-power consumer at 4½d. The loss to the flat-flame burner consumer would be 7½d., and to the incandescent burner consumer it would be just under 3d. This loss must be borne by the consumer.

[Mr. Carr was then questioned as to the publication of his diagram in the "JOURNAL" last week, p. 129; and the discussion that ensued is reported in this issue, p. 203.]

Mr. *J. G. Newbigging* then gave corroborative evidence. He agreed with the results placed before the Committee by Professor Frankland.

Further Evidence in Opposition.

The *Assistant Medical Officer for Liverpool* said he made investigations with regard to the number of flat-flame and incandescent burners in use in the poorer houses in Liverpool. Out of 8000 houses, there was no gas at all in 2669. In 5383 houses, there were 21,770 gas-burners; and they were found in houses of which the rental was from 5s. 6d. to 8s. 6d. per week. There were 10,692 flat-flame burners, 891 fishtail, and 10,181 incandescent.

Replying to Mr. HONORATUS LLOYD, witness said it was very likely that incandescent lighting was increasing; but he did not think the flat-flame burners would be displaced in the poorer houses. He thought that in the better class houses the proportion of incandescent lighting might be very much larger.

Mr. HONORATUS LLOYD then again referred to the question which had been raised with regard to the opposition of Ilford.

A Question of Price Reduction at Ilford.

Mr. *Wm. Ashmole*, the Chairman of the Ilford Gas Company, said his Company were in the No. 1 Bill. The Company had been contemplating a reduction in the selling price of gas and found they were in a position to do so. The District Council had asked them whether, in the event of their not opposing, the Company would give them a reduction, and whether the Company would also agree that, in the event of the Council proposing or supporting a Bill in Parliament for the free-wiring of the electric light (they owned the electric lighting undertaking), the Company would not oppose them. He, as Chairman, gave them to understand that the Company could not agree to either of these propositions. Subsequently, the Clerk to the Council suggested that the Company might make a reduction of 1d. per 1000 cubic feet. The Company had discussed the question last year; but they decided that they could make no reduction, for three reasons. They had the question of the assessment by the Poor Law authorities, who wished to increase their assessment very considerably; but that had been arranged, and the assessment had been considerably reduced. The income-tax authorities decided that no depreciation should be allowed to gas or water companies; and this would have affected them very seriously. But the income-tax people had come to the conclusion that the circular they then sent out was irregular. The other point was that up to the present they had been rebuilding their works; but they had now concluded this. The Company, on these considerations, decided that they could reduce the price at the end of the year; and when the suggestion of 1d. came from the Council, they agreed to give it. They did not give the reduction because they were likely to secure the standard burner Bill.

Mr. HONORATUS LLOYD: That which you had always intended to give them you said: "By all means take"?

Witness: Yes.

In answer to further questions, witness said that part of the Ilford Urban Council's district was supplied by the Barking Gas Company. They had the new burner, and they had had to pay nothing for it.

Mr. TALBOT, in cross-examination, read an agreement which had been arrived at between the Ilford Gas Company and the Ilford Urban District Council, as the terms for the withdrawal of the Council's opposition. The agreement was dated July 5, 1910, and was as follows:

> The Ilford Gas Company agree, providing they accept the Bill as passed by the House of Commons Committee, and that no reduction in the standard price is made by the Bill, to grant the consumers in the district of Ilford a reduction of 1d. per 1000 cubic feet from the current price of gas for one year certain from and after the reading of meters for the Christmas quarter, 1910. (2) In the event of the Bill being accepted by the Company containing a provision for a reduction in the selling price of gas of 1d., or exceeding 1d., the consumers to have the benefit of such reduction contained in the Bill in lieu of the before-mentioned 1d. reduction.

Witness said they could afford to give 1d. reduction without interfering with their dividend, and, quite apart from this consent, they would have given the 1d. reduction. They thought, however, that if the arrangement were made known, it would tend to prejudice the other companies.

Mr. TALBOT remarked that they had another special case to mention—that of Cambridge, in one of the other Bills; but he asked the Committee to defer their decision upon the No. 1 Bill until they had heard Bills Nos. 2 and 3.

The Case of the Liverpool Corporation.

Mr. TALBOT, addressing the Committee on behalf of the Liverpool Corporation, pointed out that, if the standard burner were allowed, the Liverpool Company would be able to supply gas of lower illuminating power than they were bound to supply to-day, and still pass the parliamentary test. There was no doubt that there would be a substantial reduction; and it would enable the Company to effect great economies in the cost of production. If the consumer desired to get either the same light or the same heat, whether he used the fishtail or the flat-flame burner, he would have to burn more gas and pay more for it. When they came to balance these considerations, it would be found that the economy to the Company was considerably greater than the decreased cost to the consumer. And Mr. Allen, by his tests of 1906, agreed with the findings of Lord Rayleigh's Committee and with the Corporation witnesses—that the loss to the consumer was greater than the advantage. He (Mr. Talbot) looked upon this as a matter of great simplicity. It was admitted that this was a Bill for reducing the illuminating power, and it was the practice of Parliament that, when there was a reduction of illuminating power, a corresponding concession should be imposed upon the Company. He failed to see how this principle could be departed from simply because the Companies in the Bill were effecting a reduction in their illuminating power by a change in the burner. What the Liverpool Corporation asked was that the Committee should not make this change at all. The Corporation did not say there were not considerations on each side; but, taking the matter as a whole, the existing test-burner involved the supply of an unusually high quality of gas, and the consumers for both lighting and heating were accustomed to that supply. All their arrangements had

been made relying on its continuance. There was no colour for saying the Liverpool burner for testing the Liverpool gas was prescribed in consequence of any prescription of the Referees, or had anything to do with the City of London Act of 1868. Their burner was adopted in 1865, since the London Gas Act was passed; and it had been twice confirmed since that time.

The CHAIRMAN: All you say is that there being a reduction in the actual supply of gas, there ought to be a reduction in price?

Mr. TALBOT: No, Sir, I ask you not to change Liverpool at all. A reduction of price would be better than nothing. I do not ask for any increase in the illuminating power, in fact; but supposing you think fit to put in the No. 2 burner, I would have no objection to that providing there is a corresponding increase. But I do not wish any change. Again referring to the paper which Mr. Allen read before the Institution of Gas Engineers in 1906, Counsel called attention to the author's opinions, which were that the inevitable conclusion to be drawn from the experiments he had then made was that a reduction in the illuminating power would be detrimental to the interests of the consumer when gas was used for lighting, whether in the flat-flame or the incandescent burner. He asked the Committee to say that no case had been made out so far as regarded Liverpool, and that it should be struck out of the schedule of No. 1 Bill.

The Case of the Mersey Docks and Harbour Board—Professor Burstall's Evidence.

Mr. BALFOUR BROWNE then proceeded with the case of the Mersey Docks and Harbour Board, evidence being first given by

Professor *Burstall*, who said he had tested the Liverpool gas and had examined the gas-engines of the Harbour Board. The heating value of the gas had no effect on either the maximum output of the engine or on the economy, provided the engine was arranged to suit the particular gas. They could obtain the full power or the highest efficiency from a gas whose heating value was as low as blast-furnace gas, with producer gas. He put in a table showing the results of tests which he had made. One gas showed 188 B.Th.U., and another 162 B.Th.U. The result was that the horse power of the engines dropped from 199 to 188. If the drop in calorific power was 10 or 15 per cent., it would necessitate altering the whole of the pipes and passages of the gas-engines, which would be a very expensive matter. He was constantly being called in to examine gas-engines; and he found that very often the trouble arose with respect to the calorific value of the gas supplied. In large towns, such as Liverpool and Manchester, the following advertisement was becoming quite stereotyped: "20 H.P. gas-engine for sale; installing larger engine." Not one gas-engine user in a hundred knew what calorific power was. In the case of the Harbour Board, the pumping out of a dry dock was a serious matter, and it was essential that within limits they should receive a gas of constant calorific power. The limit should be 2 per cent. on each side of the mean. The Harbour Board, with a drop in the calorific value of 9½ per cent., would not be able to get out of the engines the power that was obtained at present.

Mr HUTCHINSON: Do you know that since these gas-engines have been put in, the calorific value of the Liverpool gas has dropped no less than 60 units; and yet the engines are working to-day satisfactorily?

Witness: I know nothing about that.

Which is the better kind of gas for working gas-engines, a higher or a lower thermal capacity gas?—I do not care so long as it is cheaper.

Witness further said that, as the proposal stood, the gas would be dearer. He was in favour of very cheap gas. As the gas was at present supplied in Liverpool, their engines were suited for the gas, and nothing should be done to alter the bargain that existed between the consumer and the Company. If the consumers were content with the present conditions, they should be allowed to remain as they were.

Mr. R. D. Holt's Evidence.

Mr. *R. D. Holt*, M.P., a member of the Harbour Board, said the expenditure on the estate was £30,686,000. The undertaking was carried on as a public trust, not with a view to profit, but in the interests of trade. If the trade was to be successfully carried on as against competing ports, they must reduce their expenses to the lowest possible limits. The result of the change in the test-burner would be an increased consumption of gas, which would burden the estate to the extent of another £3000 a year, apart from any capital expenditure which might be necessary. The charge of 2s. 6d. per 1000 cubic feet for power was a very high price. The Gas Company had not asked them to enter into negotiations for an alteration; and it was unreasonable that the alteration should be forced upon them.

In reply to Mr. HUTCHINSON, witness said that their income was £1,500,000. Nobody would gain by the proposed alteration. The Company said they would charge a reduced price as a result of the proposed change; but it did not follow that because of this the Harbour Board would be compensated for the loss they would suffer.

Mr. HUTCHINSON put a calculation to the witness, on the basis of Mr. Carr's figure, that the saving would be 3·8d. per 1000 cubic feet. The price of 1000 cubic feet of gas was 2s. 6d. It was said that they would have to burn 1150 cubic feet in place of 1000 feet; and 1150 feet at 2s. 2·2d. was just the same sum as 2s. 6d. per 1000 feet.

In reply to Mr. BALFOUR BROWNE, witness said there was nothing in the Bill to guarantee the calculation.

Mr. BALFOUR BROWNE, addressing the Committee on behalf of the Mersey Docks and Harbour Board, said the case was unique, and was quite separate from that with which the Committee had already dealt. In opening the case for the other Bill, Mr. Honoratus Lloyd said: "I admit there is a distinction between Liverpool and the other places because of the high-grade gas supplied there." He asked the Committee, whatever they did with regard to the other companies, to leave Liverpool out of the Bill. The circumstances in Liverpool were an absolute bargain between the Company and the consumers; and it was confirmed by Parliament in 1865. A great deal of argument had arisen upon what was done after that year in London; and he admitted that the position of London was entirely different. In London, there was an indication that the burner to be used was one that would do the most justice to the gas. There was no such provision in the case of Liverpool; the bargain was that they should supply gas as measured by a particular burner. It was admitted that by the No. 2 burner the Company would be able to supply them with gas of a lower power, and yet the consumers were to be called upon to pay the same amount for it. The Mersey Docks and Harbour Board, if this were done, would have to alter all their engines and all their burners. He asked the Committee to say there was no reason shown why the change should be made, and there was not a case where the change should be allowed without some *quid pro quo* to the consumer.

Thursday, July 14.

Mr. Honoratus Lloyd's Reply.

This morning was set apart for Mr. HONORATUS LLOYD'S reply. In a very forcible speech, he said that, with regard to the opposition of the Liverpool Corporation and that of the Mersey Docks and Harbour Board, what they said was at the bottom of the whole matter was the bargain between the consumer and the undertakers at the instance of Parliament. The rock upon which his case stood was that the intention of Parliament was to prescribe an illuminating power equal in intensity to that given by x candles accurately measured. He called attention to the evidence given by Mr. Lyster, who put the matter very plainly in reply to the Chairman: "(Q) The Legislature having prescribed 20-candle gas, and prescribed the mode of testing it, would you imagine that the test was to be an accurate test of real 20-candle power gas, or something different, or something more? (A) I imagine the Legislature said: 'We must have a test—we must say what the quality of the gas is to be;' and they instituted a test which they thought would indicate the quality of the gas." On the other side, they said the burner was the cardinal point. But in order to arrive at what Parliament meant, one had to get clearly in one's mind two things. Parliament had dealt with what was known as the quality of the gas, and, secondly, with the mode of testing; and in dealing with the quality they had prescribed so many candles. When dealing with the mode of testing, they had prescribed this, that, or the other burner from time to time—always intending that it should be an accurate method of testing. His learned friends contended that a light equivalent in intensity to x candles, when prescribing a particular burner, had no meaning; and Professor Frankland was very strong on this point.

Mr. TALBOT: No; our whole case is that there is no such thing as 20-candle gas.

Mr. HONORATUS LLOYD proceeded to show how Parliament had dealt with the quality of gas and the method of testing. In the Gas-Works Clauses Act of 1871, it was provided that the quality of the gas was to be such as produced at the testing-place a light equal in intensity to that given by so many sperm candles of six to the pound; and the burner was to be as prescribed in the Special Act, or according to such rules as should be substituted therefor by any Special Act. So that, taking the quality of the gas as a fixed figure, the testing might be changed from time to time. And in the various Acts of the companies in the No. 1 Bill there was the same sort of thing. The method of testing was by the burner that was the most accurate, supposed or known, at the time. This was recognized by Parliament when fixing the basis of the financial undertaking and the quality of gas—that the prescribed apparatus might be changed in one form or another, either by the Gas Referees, by the Board of Trade, or by coming to Parliament. In the City of London Gas Act, 1868, the quality of gas was fixed when the burner was unknown. The gas was to be of an illuminating power of 14 candles; but there was no mention of a burner. Yet, on the evidence of Professor Frankland, his learned friends kept on saying that gas of so many candle power, without a prescribed burner mentioned and specified, was an unknown quantity. It was also provided that "The Gas Referees shall prescribe the burner; and it shall be such as shall be the most suitable for obtaining from the gas the greatest amount of light, and be practicable for use by the consumer." What was the good, after this, of saying that Parliament meant nothing, and could mean nothing, by speaking of an absolute gas of 14 or 16 candle power unless they prescribed the burner, and that they meant an artificial 14 or 16 candle power with a particular burner, when Parliament distinctly said that the gas was to be measured by such burner as the Referees should from time to time prescribe? It was also said on the other side that the conditions of Liverpool and London were so different; but he was not tying himself to London, although one might suppose that London would be a good sample to take. If they were to look at the London and Provincial Gas Acts and Orders, the same thing would be found running through them—not intending an artificial figure as measured by a particular burner, but intending an absolute figure measured by an accurate burner. When the question arose with regard to sulphur restrictions and the purity of the gas, the provision in the last Liverpool Act of 1882 was that the apparatus and mode of testing should be the same as now prescribed by the Metropolitan Gas Referees. So in that case, when Liverpool was dealing with Liverpool gas, they thought "How excellent is the practice of London."

Mr. FRERE (Parliamentary Agent). They kept the same burner.

Mr. HONORATUS LLOYD pointed out that the Liverpool Act of 1865 provided as to the method of testing the candle power and the test-meter; and they provided for the number of candles, for the quality of the gas, for the burner (the batswing or fishtail at 5 cubic feet an hour, giving a light equal in intensity to 20 sperm candles), and for the time and the place of testing. By the Act of 1882, they incorporated the Gas-Works Clauses Act; and notwithstanding such incorporation, sections 13 and 14 of the Act of 1865 were to remain in full force and effect. In short, the effect was that the burner was left out. Therefore Liverpool was in precisely the same position as the others—namely, they were liable to have their prescribed burner changed by Special Act. Their present burner was by no means a perfect one. They began with an iron batswing, and now they had a steatite batswing; and the evidence was that if four of these burners were put in a row there might be a difference of four candles between them. It was not as inaccurate for a high-candle gas as the No. 1 burner; but, nevertheless, it was unreliable. The evidence before the Committee stood uncontradicted—that the existing burner in Liverpool was not reliable, was not a constant burner, and was one that should not be kept if a better one could be introduced.

Then, with regard to the loss which the opponents said would accrue by the adoption of the No. 2 burner, the evidence of Professor Burstall and Mr. Lyster was all based upon the evidence of Mr. Newbigging and Mr. Carr. Mr. Lyster said he had not gone into the figures; and his evidence was based on the assumption that the loss of light and power would be that which Mr. Newbigging and Mr. Carr said it was. Professor Burstall spoke of the effect on gas-engines if the loss in power were 15 per cent.; but he did not say a word as to whether this was the amount of loss. He also accepted the figures of Mr. Carr and Mr. Newbigging.

The CHAIRMAN at this point asked Mr. Lloyd to deal with the rather forcible argument of Mr. Talbot and Mr. Balfour Browne, which was that, although the calorific power was not prescribed in any of the Liverpool Acts, it so happened that, in giving the illuminating power through a defective burner, the consumers for power had had the benefit. They said that if the No. 2 burner were substituted, a certain thing which they had had, rightly or wrongly, would be taken away; and, worse than this, they said that, in doing so, another gas would be given them which they might make up by using an additional quantity. But a different quality would be given which they could not make up at all, which might lead to very serious results with regard to their gas-engines.

Mr. HONORATUS LLOYD said he agreed, from beginning to end, that they had hitherto had something more than that to which they were entitled. The effect of what the Company were proposing to do was to give them that to which they were entitled; and by saving the expense of not having to manufacture the surplus to which they were not entitled, they would have the benefit of the result by getting that to which they were entitled, at a lower cost. Returning to his criticism of the evidence, he said that Professor Burstall and Mr. Lyster had assumed that the consumer using the flat-flame burner would lose 25 per cent. of efficiency, that the motive power user would lose 15 per cent., and that the incandescent consumer would remain pretty much where he was before, or would possibly gain a little. The 25 per cent. was arrived at by Mr. Carr, who said that the reduction would be 5 candles, which would be a quarter of 20, or 25 per cent., and therefore the flat-flame burner suffered to this extent. But the mistake of the whole thing was that the flat-flame burner did not lose 5 candles at all, or anything like it. The evidence was that the extreme difference would be 2 candles. Then, with regard to calorific power, Mr. Carr and Mr. Newbigging took the loss at 15 per cent., because the loss was 5 candles at 3 per cent. per candle. But the evidence was that the actual variation was 9½ per cent. Not only was the 5-candle loss a mistake, but the 3 per cent. was rubbish. The evidence was that it amounted to 1 per cent. This being so, what became of the apparently important evidence of Mr. Lyster and Professor Burstall, which was based upon 15 per cent.? "Mr. Carr is as bad as the No. 1," said Mr. Lloyd; "he ought to be eradicated."

Turning to the question of the use of gas in gas-engines, Counsel said much had been made of the statement that the pipes and so on would have to be entirely altered. But gas engineers did not lay pipes which were capable of carrying exactly the amount of gas they required. "It is a bogey" he said. The pipes which were in use to-day must be ample for the slight change which would result upon the slight loss of 1 per cent. calorific value. The whole calorific figure given by Mr. Lyster and Professor Burstall had no foundation of any sort, except the loss of 5 candles and the multiplication by 3. And this was absolutely contradicted by those who had had the gas to deal with, and upon whose word there could not be the least doubt. When Mr. Lyster was asked if he had not contemplated the use of producer gas—a very low-grade gas—for some of his purposes, he said "Yes." And that gas was going to be used in these same engines, which were going to suffer a terrible calamity by the loss of 15 per cent. Their evidence was based upon an absolute fallacy.

It was rather a curious position, because the Liverpool Corporation, by their Lighting Committee, passed a resolution some years ago asking for a reduction of the candle power of the gas supplied. It was the Corporation themselves who, at an early stage, when incandescent lighting and gas for heating and cooking was not used to such an extent, thought the time had come for reducing the candle power. Yet the Corporation now came and said: "We want the higher candle power." The Mersey Docks and Harbour Board said the same thing; whereas at one time they were contemplating the use of producer gas. It would be a pity if Liverpool were to be left as the only place in the whole country where 20-candle power gas was provided—a costly article, which was no good to anybody, in the sense that it might be replaced by an article equally satisfactory to everybody and of less cost to both purveyor and consumer.

The suggestion had been made by Mr. Balfour Browne that the saving might be applied in raising the Directors' fees and so on; and although Parliament had provided that the Company should be compelled to reduce their price, Mr. Balfour Browne said: "That is another mistake of Parliament; Parliament did not understand what they were doing; it is a worthless thing." It was provided that the Company must reduce the price automatically, and all the saving must go to the consumer. Then it was said "If the saving is so small, what is the advantage to the Company?" To the Company, *qua* company, *qua* finance in that respect it was no advantage. They were already receiving every single farthing of their dividend. It was amply secured; and there was no risk of the dividend being reduced. But they had to compete more and more, day by day, with the Corporation electricity; and they were anxious to be able to supply an article which was cheaper and on economical terms. The Corporation no longer required a reduction in the candle power. It would enable the gas to be more competitive with their electricity undertaking.

As an illustration of what was the truth with regard to Mr. Carr's suggestion about the terrible injury that was likely to be done by the drop in the candle power and the calorific test, he called attention to Mr. Newbigging's evidence of the state of things in Manchester. The Manchester Corporation has reduced the candle power of their gas, as measured by the batswing burner, from 20·14 to 15·30. Did Mr. Newbigging say that all Manchester was up in arms, or the gas-engines required large sums to be spent on them and larger pipes had to be laid, and that the consumers were calling for justice? Then, again, the candle power had been reduced at various large towns where there were docks; and in the other House the promoters had directed the attention of the Mersey Docks and Harbour Board to this matter. They could have brought evidence from any one of these places; but they had preferred to remain silent on the point. Under all the circumstances, he asked the Committee to say that, although there was this distinction in the case of Liverpool, the burner was inaccurate and unreliable, and it was desirable that they should be in the same category as the other companies.

Mr. FRERE again called attention to the point made by Mr. Lloyd with regard to the Liverpool Act and the inclusion of the burner, and contended that the burner was preserved by the Act of 1882.

Mr. HONORATUS LLOYD said it was provided that: "It shall be the burner or such burner as may be prescribed by any Special Act."

It was found after a discussion that the words in one Act were "any Special Act" and in another "the Special Act."

GAS COMPANIES (STANDARD BURNER) BILL (NO. 2).

House of Commons Committee.—Friday, July 15.

This Bill also proposes the adoption of the "Metropolitan" argand burner No. 2 as the standard burner. The Companies concerned are the Berkhampstead Gas Company, Bournemouth Gas and Water Company, British Gaslight Company (in respect of their Staffordshire Potteries, Trowbridge, and Holywell stations), Cambridge University and Town Gaslight Company, Chigwell, Loughton, and Woodford Gas Company, Faversham Gas Company, Harrow and Stanmore Gas Company, Hatfield Gas Company, Hemel Hempstead District Gas Company, Herne Bay Gas and Coke Company, Newmarket Gas Company, Ormskirk Gaslight Company, Prescot Gas Company, Radcliffe and Pilkington Gas Company, Reading Gas Company, Shrewsbury Gaslight Company, Tunbridge Wells Gas Company, Waltham Abbey and Cheshunt Gas and Coke Company, West Kent Gas Company, and Worthing Gaslight and Coke Company.

The opposition to the proposal came from the Bournemouth, Cambridge, Faversham, Reading, and Hemel Hempstead Corporations, and the Harrow-on-the-Hill Urban District Council. The opponents were represented by Mr. RAM, K.C., Mr. TALBOT, K.C., and Mr. COURTHOPE MUNROE.

Counsel's Opening Speech.

Mr. FITZGERALD, in opening the Bill, said the promoting Companies numbered 20, and represented in all 22 gas undertakings—the British Gaslight Company making the proposal in respect of three of their works. There was opposition in regard to six of these. In each of these cases the test-burner was the argand No. 1; and the quality of the gas varied from 14 to 16 candles. In the case of Bournemouth, the Act prescribed that the burner should be Sugg's argand No. 1, or such other burner as should be approved by the Board of Trade; and it was provided what chimney was to be used. There was the clearest evidence on the face of the Statute as to what Parliament intended—that the burner should do justice to the gas. The only speciality, if it might be called a speciality, in the companies was that the Cambridge Company were supplying 16-candle gas. The others varied from 14 to 15½ candles. When he opened the original case, he said that when in 1868 the Referees prescribed for the London Companies the "London" argand No. 1, it was the best burner that was then known for testing pure coal gas of 16-candle quality; but he also said that, as early as 1890, Mr. Harcourt, who was Senior Referee, had stated publicly that the objection to testing the London gas by this burner was that it exaggerated any deficiency in the gas. If the deficiency was a quarter-of-a-candle, it might have exaggerated it so that it appeared as half-a-candle, and so on. Since 1868, various changes had taken place in the manufacture of gas, and the No. 1 argand was not as satisfactory for testing 16-candle straight coal gas as the No. 2 burner which the Cambridge Company now wished to substitute. The Faversham Company supplied 14-candle gas, the Reading Company the same, and at Harrow it was 15 candles.

Mr. RAM said he was going to submit that, with regard to Cambridge and Bournemouth, there was no case made out, and they ought to be struck out of the Bill. Their test-burner was the No. 1 argand, or such other burner as the Board of Trade might approve. They could go to-day to the Board of Trade, not necessarily for a Provisional Order, and by direction of the Board they could use the No. 2 or any other burner. He asked the Committee to say that the preamble was not proved in respect to these two Companies, because it was provided in the preamble: "Whereas the objects aforesaid cannot be attained without the authority of Parliament."

Mr. FITZGERALD contended that there was absolutely nothing in the point. If they could not do the thing themselves, and could only do it through the intervention of a Public Department, there was no reason at all why they should not come to Parliament. It had been held over and over again that the powers vested in a public department did not prevent them coming direct to Parliament and applying for a Bill.

Mr. William Cash's Evidence.

Mr. *William Cash* gave evidence in support of the Bill, and handed the Committee a table showing all the relevant statistics with reference to the Companies. Bournemouth were a sliding-scale Company; but only a portion of their capital was subject to the sliding-scale. The price charged by them for gas had been gradually reduced from 3s. 6d. per 1000 cubic feet in 1897 to 2s. 7d. The last reduction was made in the ordinary course of business, quite apart from any consideration with regard to this Bill. The Company had built thoroughly up-to-date works at a cost of £100,000. It was a commercial undertaking, and had great competition with electric light for power and heating; so that it was in the best interests of the Company and the consumers alike that the gas should be sold at the lowest possible price. For a

great number of years they had not paid the additional dividend they were entitled to under the sliding-scale. A reduction of a penny per 1000 cubic feet amounted to nearly £3000. In reference to the maximum capital, the maximum dividend being paid any saving must benefit consumers; and under the sliding-scale, it always had been their policy to give the benefit to the consumers. With regard to Cambridge, the maximum price was 4s., and they were charging 2s. 8d. They were paying their maximum dividend. Both the Bournemouth and the Cambridge Companies had inaugurated a scheme of co-partnership, which was based on the price of gas. In Bournemouth, there was a very large proportion of incandescent burners; flat-flame burners being almost a negligible quantity.

Replying to Mr. RAM, witness said that Bournemouth was a Gas and Water Company; but there were no separate accounts kept. He agreed that if the burner was objected to, they could apply to the Board of Trade for any burner they pleased; and that if the Board of Trade approved, they would be at liberty to use it. But the Company had considered this matter, and were of opinion that the most convenient procedure was by the present Bill.

Mr. RAM: Good as the profit-sharing scheme may be, the amount which the workmen get comes, in the first instance, out of the pockets of the consumers?

Witness: In one sense it does; but I do not think there can be any question but that it inures to the benefit of the consumer.

In reply to Mr. FITZGERALD, witness said the Bournemouth circumstances were special in respect that while they had a small amount of sliding-scale capital, they had a larger amount of maximum-price capital. On the sliding-scale capital they did not divide the amount they were allowed to by Parliament; and the consumer had been getting a larger share than that to which he was entitled. The Cambridge and Reading Gas Companies were both paying maximum dividends; so that the whole of the reduction would go the consumers.

In answer to the CHAIRMAN, witness said the Bournemouth Gas and Water Company had one profit-and-loss account and one capital account. The profits from water went to the common fund. He was aware of another case where the company had separate accounts, and yet the final profit was brought into a common fund.

Mr. Charles Carpenter's Evidence.

Mr. *Charles Carpenter* said that he confirmed the evidence he had given on the No. 1 Bill. When the No. 1 burner was prescribed for the London Gas Companies in 1868, he believed it was as good a burner as could have been adopted. It was not far out. But there had been changes since then; and one of them was in the composition of the gas. Gas of an equal illuminating power produced at a low temperature had a somewhat different composition. There was more hydrogen and less marsh gas than was the case 30 or 40 years ago. Hydrogen burned with a very small flame indeed, and the defects in the argand burner were accentuated. More air was allowed to rush upwards to burn the gas, with the result that the No. 1 had even greater defects nowadays with 16-candle gas than it had at the time it was prescribed. For the accurate testing of gas, the No. 2 burner was better than the No. 1, quite independent of these ranges in composition. This was very important in the case of Cambridge, because, under their Act, there would be a penalty for any defect; whereas in London there was an allowance of half-a-candle.

In reply to Mr. RAM, witness agreed that he had previously said that with 16-candle gas it made no difference whether the No. 1 or the No. 2 burner was used.

Mr. RAM pointed out that, prior to 1868, the London Gas Companies were supplying gas of 12 candles with the Sugg-Letheby argand. In that year, the City of London obtained parliamentary powers to raise the candle power to 14; and after 1870, it was to be 16. The Company asked for the burner that would give the best light; and they got rid of the Sugg-Letheby burner, and took the "London" argand No. 1.

Re-examined by Mr. FITZGERALD, witness said that, so far as he knew, there was nothing to connect the illuminating power and the burner in any way. At that time, the authorities thought that the higher the illuminating power the better; but it was found that the richer gas was more expensive. A more expensive coal had to be used, which made the unit of light more costly to produce. Owing to the change in the manufacture of gas, the No. 1 burner was not as accurate now as it was then.

The CHAIRMAN said he understood Mr. Ram's point to be that Cambridge had 16-candle gas prescribed; and if the argand No. 1 was good enough for that, why did they want the No. 2?

Witness said 16-candle gas meant gas of about 16½ candles; and as long as they had that, there was not much in it. But as soon as they got down to the border line, the trouble began. The excess of air rushed into the burner, and down would go the light. What he called 16-candle gas was what the gas companies really provided—16½ candles; and with this quality there was no difference. But when they came down to the scientific 16 candles, its illuminating power was unduly reduced by the excess of air. He believed that the uniformity which would result from the adoption of the No. 2 burner would be of great value. In order to know the correct volume of gases, the temperature and the pressure of the testing-room had to be taken into consideration; and there were other matters which the Board of Trade could not prescribe. This was the unfortunate part of that Department's authority. They could prescribe the burner, but not the regulations. These regulations were given in London by the Gas Referees under their powers.

Mr. RAM: Why should this not be done by General Act, instead of piecemeal by different companies?

Witness: Unfortunately the Government and the Board of Trade were so busy that they could not take up an Act. That is why the gas companies are doing it themselves. Sir George Livesey took up the matter; and this was their reply.

Mr. FITZGERALD: We would have been only too glad to have been saved all this expense.

This closed the case for the promoters.

The Case for the Opposition.

Mr. RAM said he did not propose to call any evidence. The Bournemouth Company were supplying 15½-candle gas, and the Cambridge Company 16-candle gas. With regard to the latter Company, he submitted that there was no necessity for the change of burner. Under their Act, the Company were able to go to the Board of Trade and get the No. 2 burner if they wanted it. Had they chosen to do this, there would have been a local inquiry, and far less expense would have been incurred than in coming to Parliament. The alteration was utterly useless and unnecessary, and would result in no practical advantage. Part of the promoters' case was that they wanted uniformity of testing; but if every company in the Bill were given the burner, there would not be uniformity. Unless there were some provision for an adjustment in each case according to the circumstances, a burner would be imposed upon the consumers which in each different case would produce a different effect, causing greater hardship in some cases and smaller hardship in others. If the Committee decided to pass the Bill, he would ask for the nominal candle power to be raised in some cases, and in others the price should be lowered; or he would ask for a clause that there should be an adjustment made so as to meet the fairness of each case. The main point underlying everything was that, if the companies were given the advantage they were seeking, there ought to be a compensatory advantage given to the consumer.

Mr. FITZGERALD called attention to Mr. Ram's point with regard to the illuminating power of the burner under the Act of 1868; but so far as he could see, there was nothing whatever to be inferred from that Act. There was no evidence upon it; but he contended that the change in the illuminating power of the gas had nothing whatever to do with the provision as to the burner.

Mr. RAM: They were given the burner; and in the same Act the candle power was increased.

Mr. FITZGERALD said the provision as to the burner came under quite a separate heading.

This closed the case on No. 2 Bill.

THE No. 3 BILL.

This Bill is promoted by the following Companies: Aberdare and Aberaman Consumers' Gas Company, Bath Gaslight and Coke Company, Exeter Gaslight and Coke Company, Godalming Gas and Coke Company, Guildford Gaslight and Coke Company, Hampton Court Gas Company, Ipswich Gaslight Company, Mid-Kent Gaslight and Coke Company, Plymouth and Stonehouse Gaslight and Coke Company, Richmond Gas Company, Romford Gas and Coke Company, Southampton Gaslight and Coke Company, Walton-on-Thames and Weybridge Gas Company, Weston-super-Mare Gaslight Company, and Wolverhampton Gas Company.

The Case for the Bill.

There was opposition from the Bath, Exeter, Guildford, and Southampton Corporations, and the Romford Urban District Council. For these authorities Mr. RAM, K.C., Mr. TALBOT, K.C., and Mr. MUNROE appeared.

Mr. FITZGERALD very briefly introduced the Bill, pointing out that there was no opposition with regard to ten of the companies. The Bath Company were supplying gas of 14-candle power, Exeter 14-candle power, and Romford and Guildford 15-candle power. He was not aware of any special feature with regard to any of them.

Mr. *William Cash* placed before the Committee a table giving statistics relating to the companies. In the case of Bath, he agreed that the prescribed burner was Sugg's argand No. 1, which, with the consent of the Bath Corporation, might be altered to any other burner prescribed and approved by the Board of Trade.

In answer to Mr. FITZGERALD, witness said this provision contemplated that an alteration of the burner was to be made from time to time. The Company were now asking for this alteration; and the Corporation had the opportunity of coming before Parliament and objecting to it if they thought fit.

Mr. *Charles Carpenter's* evidence was to the effect that what he had already said applied equally to this Bill.

Mr. RAM, in addressing the Committee, said the two cases which stood out from the others were Southampton and Bath. In the case of Southampton, they had the provision, as in the Bath case, with regard to the application to the Board of Trade. The prescribed burner was to be any burner for the time being approved by the Board of Trade, or if there were no such burner, then it was to be Sugg's "London" argand No. 1. It was even more than this, because it was provided that if at any time the Board of Trade approved a certain burner, it became the burner in the constituency. Without further ado, the burner automatically became the test burner. In the case of Bath, the burner was to be Sugg's "London" argand No. 1 or, with the consent of the Corporation, any other burner prescribed or approved by the Board of Trade; and the Corporation of Bath were there before Parliament to refuse their consent. In Richmond, which was also in this Bill, there was a similar provision; but there was now a new clause relating to Richmond which provided: "Nothing in this Act contained shall, unless otherwise agreed between the Mayor, Aldermen, and Burgesses of the Borough of Richmond (Surrey) and the Richmond Gas Company, apply to, or affect, the Borough of Richmond." In the case of Bath, they were now trying to override the consent of the Corporation, and take away the power that had been given to them.

Mr. *E. C. Cooper* (of Messrs. R. W. Cooper and Sons, Parliamentary Agents to the Bill) was called to give evidence with regard to the clause which had been given in the case of Richmond. He said the Richmond Corporation and the Richmond Company had an agreement by which the Company were entitled to use the standard burner No. 2. But, in addition to supplying the Borough of Richmond, the Company also supplied a considerable district outside; and the agreement related only to the borough. It was necessary, on this account, that they should be included in the Bill.

In reply to Mr. RAM, witness said that there was also an agreement between the Corporation and the Company that the price to be charged in respect of public lamps was to be £3 instead of £3 5s., and the

Company were to furnish and fix flat-flame burners suitable to the quality of gas supplied.

Re-examined by Mr. FITZGERALD, witness said that, under the Gas-Works Clauses Act, the price fixed for gas to the ordinary consumer did not apply to public lighting. If the Local Authority and the Gas Company did not agree as to the price for public lighting, it was to be settled by arbitration; and to avoid arbitration proceedings, the price was agreed between them.

Mr. RAM argued that the agreement was made as the result of the Act of 1901, whereby the Company and the Corporation of Richmond might agree to use other testing apparatus. The Company got the advantage of using the No. 2 burner, and the Corporation obtained the advantage of having 5s. off every one of their lamps; and they secured for the consumers the further advantage of having free burners supplied to them when a change of burner was necessary. These were the circumstances under which Richmond consented to the change. Bath to-day were in the same position; but the promoters were seeking to take away their veto.

Mr. FITZGERALD stated that the agreement was come to two years ago, wholly independent of the promotion of this Bill.

The CHAIRMAN thought the clause with regard to Richmond was quite justified; and he was going to ask whether the promoters would give Bath a saving clause.

Mr. FITZGERALD did not think it would be at all reasonable, because the positions of the Bath and Richmond Corporations were entirely different. As to Richmond, the Corporation were not 25 years ago in possession of an electrical undertaking; but to-day they were, which altered the condition of things.

The CHAIRMAN remarked that it was a point whether it would be just that the Committee should override this without the consent of the Corporation. He did not think, *prima facie*, that they ought to take away the power of the Corporation by a General Act such as this.

Mr. FITZGERALD said that if the Committee came to the conclusion on the preamble of the Bill that, with regard to the other Companies in the Bill, the No. 2 burner ought to be adopted for testing the gas, there was absolutely nothing in the circumstances of Bath which prevented the burner being applied and doing justice there, as with the other Companies.

Mr. RAM said the Corporation had never been asked to consent to a change of burner.

THE COMMITTEE'S DECISION ON ALL THE BILLS.

After the luncheon interval,

The CHAIRMAN delivered the decision of the Committee as follows: The Committee have arrived at the unanimous conclusion to pass the preambles of all these three Bills; and it will be sufficient as to the preambles to say this. But it is perhaps necessary to say a word or two more as to the case made against the Bills. In the first place, the Bills are promoted by 43 companies in all, of whom less than half are opposed by local authorities. The Bills as to the unopposed companies therefore must be taken as going without opposition. As regards the opposition, it really is not against the principle of the Bills at all, because it is common ground to both sides, and to all parties, that the burners hitherto in use have been defective, and that the burner proposed to be established as the standard is, if not perfect, yet as perfect as is at present known for achieving the object of Parliament in giving what they certainly intended to give—that is, a light equal to the light of so many candles. The question between the two parties is whether the burner, which I call a measure (several metaphorical descriptions have been given, but I like the practical word "measure," because it is a measure of the luminosity quite as much as an ordinary gas-meter is a measure of the quantity of gas), was made as much the cardinal point in the bargain as the standard of light. My opinion is that, as the standard of light—and I think that all will agree—Parliament certainly intended to give a light equal to the prescribed number of candles. They pitched, unfortunately, on an instrument which was thought at that time by all the parties to the bargain, including Parliament itself, to be accurate. It turned out not to be an accurate one, and it necessitated the supply, to perform the statutory obligations, of a higher quality gas than the parties at the time thought they were prescribing. However, it was enacted; and for a series of years gas was supplied which cost the companies more. When a more accurate instrument came to be invented, they were able to rectify the difficulty; and a saving was undoubtedly effected by the companies by this operation. This saving, it is suggested, will be made at the expense of the flat-flame consumers, who will get—and it is, perhaps, not absolutely disproved—a little less light (though some of the witnesses said it will be imperceptible) than the prescribed number of candles would entitle them to. Some consumers have contended that, because the companies make a saving or a profit, therefore the consumers ought to be compensated. But the Committee unanimously are unable to see this, and to recognize that the fact of the burner, which was supposed to be perfect and has been found to be imperfect, having perhaps done a wrong to somebody in practice, gives any right to compensation further than the legislation appplicable to gas companies will automatically give to them. The legislation affecting gas companies has been a great deal more strict, as regards both the application of capital and profit, than legislation affecting local authorities and municipal corporations, who have a much greater latitude. It has been suggested that the savings might be misapplied, although at the same time wrong-doing was distinctly disclaimed by the petitioners as a charge against the directors of the gas companies. Anyhow, it is quite clear, as regards the maximum-price companies, that the whole of the savings must go, if legally applied, to the benefit of the consumers. The hardest case of all, as regards the consumers, was that of the Mersey Docks and Harbour Board. No doubt they did, on their evidence—rather exaggerated, we think, by their fears—show, or at all events endeavoured to show, that they would incur damage and loss larger than would be compensated by the savings which would be effected by the Company, and which would, they being a maximum-price Company, have to be given to the consumers. The Mersey Docks and Harbour Board being the largest consumer, a reduction, we find on calculation, of 1d., would be equal to about £950 a year; and the expected reduction of possibly 3¾d. would give a reduction in the case of the Board of nearly £4000 a year. These figures may not, perhaps in the future work out exactly; but we think, at all events, making an abatement for the exaggeration of their fears, and taking into consideration all that they have put before us as regards any loss and inconvenience they may sustain, they will be practically compensated by the reduction which may be expected from the Company, who appear to have conducted their affairs with honesty and fairness towards consumers as well as towards shareholders. At all events, the contrary is not alleged against them; and we are disposed to give them credit for that. All changes are inconvenient in almost every line of life to somebody or other; and this change may perhaps alter the amount of compensation, or rather may differentiate the amount of compensation, that would be given to some consumers as between them and others. But it is not competent for us, as a Parliamentary Committee in dealing with a gas company, to distinguish between one set of consumers and another. The incandescent burner people would perhaps be greater gainers than any other class of consumer; but we cannot go into, and differentiate and apportion, the respective profits and savings which would, by distribution in the shape of reduction in price, accrue to the different consumers. For these reasons we think that the Bills should be passed, and we should not be disposed to entertain applications for compensation.

Mr. BALFOUR BROWNE said he was not quite sure that he understood one portion of the Committee's decision. The calculation had been made that 3¾d. would give between £3000 and £4000 a year to the Mersey Docks and Harbour Board.

The CHAIRMAN said this was not absolutely proved; but it might go as high as that.

Mr. BALFOUR BROWNE asked if it was the intention that the Company should put this money in their pockets at the expense of his clients.

The CHAIRMAN: Certainly not, it will be applied in the reduction of price.

Mr. BALFOUR BROWNE: Is t your intention that they should reduce the price by this amount?

The CHAIRMAN replied that they were bound to, by the automatic operation of the Gas Act.

Mr. BALFOUR BROWNE remarked that they had dealt with the automatic reduction of price; but this did not touch the question which was submitted to the Committee. He only wanted to know whether it had been dealt with—the enormous expense that the Mersey Docks and Harbour Board would be put to in altering their engines and in increasing again the lighting of their sheds and quays. It might mean £2000 or £5000 in each case; and if it was found to be so—that this was the loss to them—was it the decision of the Committee that they were to bring up a clause and have compensation for this?

The CHAIRMAN answered that the Committee had taken this matter into consideration; and they thought the fears of the Harbour Board were exaggerated. But supposing there was any little alteration of the pipes or engines, the compensation which the working of the Act would give, and the reduction of price consequent upon it, should be ample solution of that question.

Mr. BALFOUR BROWNE pointed out that they would not be compensated for the capital loss; and the question of a reduction in price was entirely in the hands of the Company.

The CHAIRMAN said the arguments for compensation had been very powerful, and the Committee attached weight to what had been said; but they had considered everything.

Mr. RAM then asked whether the decision applied to Bath.

The CHAIRMAN replied that it did. Theirs was an exceptional position; and there was no doubt the Corporation had a right to be heard. They had had this hearing before the Committee; but they had not the right of absolute veto, and they could not override the Board of Trade.

Mr. RAM: The operation of the powers of the Board of Trade could only come into action at all if the Corporation consented.

The CHAIRMAN agreed. He thought that Mr. Ram's view was very forcible; but it was not expedient from the point of view of policy that the Corporation should have the right of saying "No" for ever to any alteration which the Company proposed. The Corporation had been heard; and the Committee had come to the conclusion that, in this case, they should decide in favour of the change.

Mr. RAM then said that, on the decision, there were a number of clauses they were anxious to bring up; but some of them were excluded by the decision. There were other clauses, however, which they asked to be allowed to place before the Committee.

Mr. FITZGERALD, having perused the clauses, said that if they were adopted there would be nothing left in the Bill. The whole question that Bath had desired to raise was on the preamble, and now, after the decision on the preamble, they were seeking, by bringing forward clauses, to cut out of the Bill clauses 4 and 5—the effective clauses.

Mr. RAM also indicated that there was a clause in regard to Liverpool dealing with calorific power.

Mr. FITZGERALD contended that the question of calorific value was entirely outside the purview of the Bill, and had not been suggested throughout the controversy.

The CHAIRMAN: I certainly do not think we should insert a test for calorific power. This is entirely a new move in legislation. A test for calorific power is a new thing. As a matter of general legislation, it is very expedient; and I hope some day we shall arrive at that.

Mr. FITZGERALD said the opponents might just as well ask the Committee, because they were dealing with gas companies, to put in a clause that every gas company should be bound to sell its undertaking within six months.

The CHAIRMAN: With regard to the clause as to calorific power in this Bill, which relates not to the whole kingdom, although it is going

to be a sort of step in general legislation relating to gas, it asks us, for the first time in the history of legislation, to prescribe what shall be the calorific test of the gas supplied by all these companies.

Mr. RAM said he was prepared to argue the matter at the right time.

The CHAIRMAN: No; I think it is outside the Bill. The evidence that we have gone into, which is within the issue (as recognized by both parties) raised by the Bill, has not gone into the question, which is a scientific one, of what shall be the calorific test for gas. It is too large a question.

Mr. RAM said the matter was raised on their petition, and was one on which they were entitled to be heard; and he submitted that it was within their competence to bring up any clause. Then the Committee could say whether it met with their approbation or not.

The CHAIRMAN: No; I think it is too cardinal a matter. It is a question which ought to have been brought up before.

Mr. FITZGERALD said a clause had been handed to him for the protection of the Liverpool Corporation. It began by raising the question about the proportion of carbonic oxide in gas, which had nothing whatever to do with the Bill.

The CHAIRMAN: I do not think we are going to decide any of these scientific questions, when we have not had evidence upon them. It is a new issue. All these are new issues altogether.

Mr. FITZGERALD said the proposal with regard to Liverpool was not a matter which could be properly raised on the Bill. It was proposing to alter the general law of gas supply with regard to the amount of carbonic oxide which might be present in the gas.

The CHAIRMAN thought the Committee were not competent to deal with it.

It was eventually decided that the Committee would consider clauses on Monday (yesterday).

Trading Undertakings at Mansfield.

Satisfactory reports have been issued of the past year's working of the Mansfield Corporation gas, water, and electrical undertakings. As to the gas-works, the receipts from sales were about £750 more than in the previous year; while residuals realized about £1050 more. The expenditure on the manufacture of gas was over £1000 more; this being entirely on account of repairs and maintenance of works and plant. The price of gas has been reduced 1d. per 1000 cubic feet; and to slot-meter consumers the discount has been increased from 1d. to 1½d. per shilling collected. The Committee have decided that the sum of £1500 be paid over to the general district rate at the present time; and the question of any further payment will be considered in October. In connection with the water undertaking, it is reported that the net profit is about £300 more than last year. The Committee have decided to pay over the sum of £2400 to the general district rate, and to appropriate the balance of £154 to the reserve fund. The accounts of the electricity undertaking show a net profit of £135. The Committee have decided to pay over the sum of £100 to the general district rate, and to appropriate the balance of £35 to the reserve fund.

Brixham Gas Company.—It was decided at a meeting of this Company last Thursday (Mr. W. A. Shultz presiding), to raise £5000 on debentures and issue 250 additional ordinary shares of £10 each, for the purpose of laying down electric lighting plant in the town.

Reduction in Price at Leek.—At the meeting of the Leek Urban District Council last Tuesday, it was recommended that, as from the 1st inst., the price of gas to ordinary consumers should be reduced to 2s. 10d. per 1000 cubic feet, subject to the usual discounts; and that in the case of prepayment meters, the discount be at the rate of 5d. instead of 3d. per 1000 cubic feet. An objection was raised by one member, on the ground that, as the gas undertaking belonged to the town, the consumers should pay a reasonable price for their gas; the reduction proposed being equal to an additional rate of 3d. in the pound. Eventually, however, the recommendation was adopted unanimously.

Explosion at the Oswaldtwistle Gas-Works.—An explosion and fire occurred at the Oswaldtwistle Urban District Council gas-works on Monday of last week—resulting in burns and shock to three men, and destruction of property of an estimated value of £500 (which is fully covered by insurance). A man named Drousfield, it appears, was engaged in testing the station-meter on behalf of a firm of manufacturers; and from some cause which is at present unexplained an escape of gas became ignited, and the resultant explosion wrecked the house and caused a fire, which, however, was promptly got under. The men who were in the meter-house at the time declare that there was no light there. Some inconvenience was naturally caused to consumers for a short time; but this was soon put right. The latest reports state that the injured men are making satisfactory progress towards recovery.

Gainsborough Gas Undertaking.—The profit and loss account for the year to March 31 was presented at last week's Council meeting by Mr. Cooper, J.P., the Chairman of the Gainsborough Gas Committee. The receipts were £14,736, and the expenditure £14,038—leaving a profit for the year of £698. For prompt payment of accounts extra discount has been allowed, amounting to £157 more than last year. Coal cost £548 less, and renewals of mains and service pipes were considerably lower than the previous year. The receipts from residuals show a decline of £128. The quantity of gas made was 82,689,000 cubic feet—a decrease of 3,131,000 cubic feet. The make of gas per ton of coal carbonized was 11,314 cubic feet, an increase of 62 cubic feet per ton—more gas having been obtained from each ton of coal than has been done before. Gas-cookers still continue to increase in popularity. The number in use at this date is 946, an increase of 94; and more consumers are being added who are using gas for lighting purposes. The number of consumers is 2752—an increase of 168 as compared with last year. The Committee are satisfied that, considering the state of trade, the result of the past year's working was very satisfactory.

MISCELLANEOUS NEWS.

EUROPEAN GAS COMPANY.

Administrative Changes.

The Annual Meeting of this Company was held last Tuesday, at the London Offices, Finsbury House, Blomfield Street, E.C.—Mr. R. HESKETH JONES in the chair. Before commencing the proceedings, the Chairman read a letter from Mr. R. S. Gardiner (one of the Directors), who asked that his absence might be excused, owing to the serious illness of his wife. Words of sympathy were expressed by the Chairman.

The SECRETARY (Mr. W. B. Brady) read the notice convening the meeting, and also the Directors' report and the accounts for the year. The report was as follows:

The Directors are gratified to be able to report that, with the exception of Havre (where there has been a slight decrease of ½ per cent.), all the Company's stations show an increase in rental, amounting, in the aggregate, to nearly 2 per cent., although the quantity of gas made is practically the same as last year.

The cost of coals has been less during the year under review; but the return from coke has also been less. The major portion of coke sold by the Company is used for domestic purposes, and when, as last year, the winter proves mild, the value of this residual is much depressed.

The prices obtained for tar have, on the average, been practically the same as those of last year; but sulphate of ammonia shows a slight improvement.

The rate of exchange ruled exceptionally high during the year; so that the loss under this heading shows an unusual increase.

The profits for the year enable the Directors to recommend the payment of the same dividend and bonus as last year, free of income-tax—viz., a dividend of 20s. per share on the fully-paid shares, and 15s. per share on those £7 10s. paid, less the interim dividend of 10s. and 7s. 6d. per share respectively paid on Feb. 1 last; also a bonus of 2 per cent. on all shares, according to the amount paid thereon, subject, however, to a deduction for French stamp and transfer duty of 1s. 1d. per fully-paid share, and 10d. per share £7 10s. paid, in respect of all shares held in France.

The Directors have to record certain changes in the Board of Management since the last general meeting. Mr. H. E. Jones, so well known to the shareholders, has been appointed Deputy-Chairman. Mr. W. Williams, who has acted for many years as Secretary and General Manager, has been elected to a seat on the Board as Managing-Director. Mr. N. E. B. Garey has felt it desirable to relinquish his position as Director, after having been connected with the Company, as Auditor and Director, for 34 years. As already notified, Mr. A. T. Eastman has, subject to the confirmation of the shareholders, been appointed to fill the vacancy. The vacancy in the auditorship caused by Mr. Eastman being nominated on the Board, has been temporarily filled by the appointment of Mr. H. J. Luff.

Notice has been given that two Directors (Messrs. H. E. Jones and R. S. Gardiner) and both Auditors (Messrs. J. Reeson and H. J. Luff) retire from office at this meeting; but, all being eligible, they offer themselves for re-election.

The CHAIRMAN, in addressing the shareholders, said he would briefly allude to the present and prospective position of the Company, which he could assure the shareholders was most satisfactory. The notice convening the meeting referred to recent changes in the administration of the affairs of the Company. It would have been noticed that Mr. H. E. Jones had been elected Deputy-Chairman. This came about consequent on an accident he (the Chairman) met with in Paris on March 24, in the course of a visit to the stations, and which prevented him from attending the meetings of the Board for several weeks. His friend and namesake very kindly acted for him during his absence; and to him he now, in the presence of the shareholders, tendered very hearty thanks. This also led him to consider the advisability of appointing Mr. Williams as Managing-Director, in recognition of the valuable services he had rendered to the Company for the past 32 years, and especially during the last eighteen years since the death of Mr. Backler, the former Managing-Director. He felt sure the shareholders would approve of this action of the Board, and offer Mr. Williams their congratulations, hoping that for many years to come he would be able to continue his valued services, which had so much conduced to the prosperity of the Company. The appointment of the Assistant-Secretary (Mr. Brady) as the Secretary followed. The Board missed at their meetings Mr. Garey, who, after a connection of about 34 years with the Company, had now retired at a ripe old age. He (the Chairman) was sure the shareholders would all unite with him in wishing Mr. Garey good health and peaceful enjoyment during the remainder of his life. As to Mr. Eastman, who came before the shareholders that day for their approval to succeed Mr. Garey, he could only say that his personal knowledge of his abilities warranted him in recommending the confirmation of his appointment. He had been a painstaking colleague for twenty years as an Auditor, and also as a Director, in other gas undertakings. With the new Auditor, Mr. Luff, the Secretary of the Oriental Gas Company, he (the Chairman) had been connected for some years as a Director and Chairman of that Company; and he was fully cognizant of his abilities. Turning now to the accounts. Owing to the continued depression of gilt-edged securities, the Directors had written off £10,794 to meet the market value of their securities on March 31 last; and the dividends receivable had been debited in the profit and loss account with this sum. The Directors' report alluded to an aggregate increased revenue from gas of 2 per cent. They had obtained 3648 additional consumers during the year, making the number 83,261. The concessions averaged 25 years. Considerable improvements in the manufacture of the gas at several of the stations had been carried out in the course of the year. Of this, the Deputy-Chairman was more competent to deal with than he. A substantial and steady dividend, and an assurance from the Directors that there appeared nothing in the future to diminish the present prosperity of the Company, were more pleasing to a shareholder than wearisome details of dry statistics; so he would conclude his brief remarks by formally moving the adoption of the report and accounts.

The DEPUTY-CHAIRMAN (Mr. H. E. Jones), in seconding, said that the

report contained, for the first time over a long period, references to several changes. Although their esteemed Chairman had passed over the matter very lightly himself, he (Mr. Jones) was bound to tell the shareholders that the Board were much concerned for a while after their Chairman met with an accident in Paris, which upset his health and condition somewhat considerably for a time. Then it was that their Chairman thought he needed to strengthen the Board; and he took the first step that led to the appointment, as Managing-Director, of their worthy colleague and able General Manager. Before passing to other matters, they must congratulate first very heartily their Chairman, and, secondly, themselves, on the fine, robust health he enjoyed, and which had enabled him to pull through what might have been to a weaker man a very serious accident. For the Board and for that gathering, he might say that they rejoiced exceedingly to again see Mr. Hesketh Jones in the chair, and again receiving his benign and friendly counsels. But feeling there was some possibility of not seeing quite so much of their worthy Chairman in the future as in the past, he (Mr. Jones) had been asked to accept the Deputy-Chairmanship; and this he felt to be a high compliment. So long as he was honoured with their confidence, any experience that he had would be entirely at their service. The next change was that their worthy and highly regarded colleague, Mr. Garey, felt advancing age; and on expressing a wish to be relieved of further responsibility and work, the Board could do no less than accept his resignation. They felt at the same time especial pleasure in being able to place in the vacant position (relying, as he was sure they might, upon the support of the shareholders) Mr. Eastman, who was connected with Mr. Garey, and in whom their late colleague had great confidence. Mr. Eastman having left the auditorship, they also felt very safe in obtaining the services of the Secretary of another Gas Company, who, from his very position, was a professional gas accountant, and therefore was better than an amateur. Regarding their works, he (the Deputy-Chairman) had lately been round them with their Managing-Director; and he could assure the shareholders that the condition they were in—the substantiality and the order in which they were kept—the method, and the success with which all their operations were proceeding, were extremely gratifying to him. At the present time, the gas industry was much exercised over carbonizing methods. Temperatures and machines were now being used for accomplishing their purposes which were never dreamed of a few years ago. The new methods were capable of producing higher results; and they had now at some of their works, and would in a short time have at all their works, some of the best and most up-to-date appliances. All their works were administered by gentlemen whom it was a real pleasure to meet. They were all industrious, careful, and right-minded men; and most of them had been in the service of the Company for many years. The Board were assured they were giving their best efforts and services to the Company. In London, they had in Mr. Brady and his staff exceptional qualification. They were all good linguists, and did their best in the Company's interests.

Mr. L. R. WILKINSON asked whether the small increase in the consumption of gas, of 2 per cent., was due to climatic conditions or to stagnation of trade. He would also be interested in knowing whether at any of the stations of the Company there were vertical retorts; and, if so, of what type were they.

The CHAIRMAN said, in reply to the first question, he must confess they had had stagnation of trade in Normandy. Respecting the second question, they had no vertical retorts.

The motion was unanimously agreed to.

On the proposition of the CHAIRMAN, seconded by the DEPUTY-CHAIRMAN, the dividends and bonus recommended in the report were duly declared.

Proposed by the CHAIRMAN, and seconded by Mr. HENRY C. SMITH, Mr. H. E. Jones was re-elected to his seat at the Board.

The DEPUTY-CHAIRMAN, in the course of his acknowledgment, when referring to the question as to vertical retorts, said they were only suitable for very large gas-works; while the whole of the works of the Company put together would only represent about one-half of the smallest of the London Gas Companies. Such a unit as a vertical retort would be in most of their works absolutely too clumsy. For the largest works, the Board had been considering them; but the Directors would like to have a little more knowledge of their success in different positions. Which system was exactly the best, they did not yet know. The policy of the Directors had been rather a conservative one; and they would not spend capital until they knew they had absolutely the right thing.

On the motion of the CHAIRMAN, seconded by the DEPUTY-CHAIRMAN, Mr. R. S. Gardiner was re-elected a Director.

The DEPUTY-CHAIRMAN moved the confirmation of the appointment of Mr. Williams as Managing-Director. He remarked that the shareholders could not tell the advantage to a Board of having at their side, with the influence and position of a Director, a man who knew the whole of the business and position of the Company in to out; and in the whole range of his knowledge, he knew of no one more capable, or one who knew more thoroughly the European Gas Company, or who devoted himself more heartily to their service, than Mr. Williams.

Mr. SMITH seconded the motion; and it was cordially carried.

Mr. WILLIAMS said he should like to thank the shareholders very heartily for the honour they had done him in confirming the appointment of the Board. It came as the crowning-point in a career of some 32 years; and although the Deputy-Chairman had been good enough to say some handsome things when proposing his election, still the recognition by the shareholders of services in such a flattering manner as this—a manner especially flattering to an official—was to him most eloquent indeed. He should do everything in his power to justify this extension of confidence, and to devote himself to the utmost to further the interests of a Company which had been very successful in the past, and which, as far as they could see, would be equally successful in the future.

On the motion of the CHAIRMAN, seconded by Mr. SMITH, the appointment as a Director of Mr. Eastman was also confirmed.

Mr. EASTMAN expressed his appreciation of the honour.

The Auditors (Messrs. J. Reeson and H. J. Luff) were reappointed, on the motion of Mr. GOLDSMID, seconded by Mr. L. R. WILKINSON.

The DEPUTY-CHAIRMAN proposed a vote of thanks to the officers and staff at home and abroad. He said he had already spoken of the services rendered to the Company by their staff abroad. Regarding the London staff, Mr. Brady, who now occupied the position of Secretary, was one of the most accomplished linguists he (Mr. Jones) had ever heard. He had been many years in the service of the Company; and he knew his ambition and hope had been that he would some day become Secretary. This ambition and hope had now been realized. Both he and his staff were all men in whom the Board had the greatest reliance.

Mr. WILLIAMS seconded the motion, and confirmed all the Deputy-Chairman had said.

The motion was heartily agreed to.

The SECRETARY thanked the shareholders for the vote on behalf of himself and staff and all his colleagues abroad. It had, he said, been his privilege for 30 years to translate the report of the proceedings, and to send it abroad to his fellow-officers; and they had always expressed their appreciation of the shareholders' vote of thanks. He thanked the Deputy-Chairman for the kind words he had employed regarding himself (Mr. Brady). Whatever services he had rendered in the past, he should endeavour to continue in the future.

Moved by Mr. H. D. ELLIS, seconded by Mr. REESON, the Chairman and Directors were also heartily thanked for their services.

The CHAIRMAN'S acknowledgments terminated the proceedings.

DEVONPORT GAS-WORKS.

£6000 Required for Further Improvements.

An inquiry was held at Devonport on Friday by Mr. E. H. TULLOCH, M.Inst.C.E., a Local Government Board Inspector, respecting an application by the Corporation for power to borrow £6000 for the purpose of the gas undertaking.

The TOWN CLERK (Mr. R. J. Fittall) explained that when the Corporation took over the undertaking in 1902, the works were in a very dilapidated state; the Gas Company not having raised fresh capital for many years previous to that time. The retort-house was in a ruinous state, the purifiers inadequate, the gasholder capacity insufficient, and the coal-stores not large enough. Recognizing that extensive alterations and extensions would have to be made, the Parliamentary Committee gave the Corporation specific powers to borrow £100,000. This amount was founded on a rough estimate, and proved inadequate to carry out all the improvements then contemplated. The works now proposed had been rendered necessary, not only to bring them into a state of efficiency, but to cope with the increase in the output of gas, which was 33 per cent. more than when the Corporation took the works over. It was proposed to spend £1500 in providing new bench-fittings and mains and a new governor in the retort-house. It was estimated that the effect of this would be to save 2d. per 1000 cubic feet of gas made, or over £3000 a year. The existing yard mains were inadequate, and £550 was required for additional 24-inch mains. A further sum of £550 was needed for providing two exhausters of 60,000 cubic feet per hour. The present exhausters were working at their full capacity; and there was no stand-by in case of accident. New washers and scrubbers were wanted; and for these £2000 was put down. The existing plant of this kind was from 50 to 60 per cent. short of present requirements, and had been installed over 50 years. The last item was £1400 for workshops, messrooms, and lavatories—all urgently needed.

Mr W. P. TERVET, the Gas Engineer and Manager, explained the plans which he had made of the proposed works.

Alderman TOZER, Chairman of the Gas Committee, said that, owing to the enormous number of complaints, especially during last winter, as to the quality of the gas, it had become absolutely necessary to effect further improvements. The saving of 2d. per 1000 cubic feet in the cost of manufacture which the Engineer estimated could be made would more than compensate for the outlay.

Mr. R. J. RENDLE, a former member of the Town Council, strongly opposed the application. He complained that the Gas Committee had pursued a wrong policy in the past, and had not spent money on what was really essential. A new retort-house should have been put up in the first instance.

The INSPECTOR suggested that it was a little inconsistent to say that the retort-house should have been put up in the first instance, and then to oppose it being done now.

Mr. RENDLE replied that he did not want any more money spent. He did not trust the Gas Committee.

The TOWN CLERK explained that the Gas Committee acted originally under the advice of the Engineers who were engaged by the Corporation in connection with the acquisition of the undertaking. When they realized that the £100,000 granted by Parliament for the improvement of the works was running out more quickly than they anticipated, they put the matter in the hands of their own Gas Engineer; and he carried out, so far as the money would go, such of the works as remained to be completed. Everything was by contract. Half the benches in the retort-house had been reconstructed out of revenue.

Mr. H. BANBURY, another ex-member of the Council, also opposed the granting of the loan, on the ground that £50,000 of the previous expenditure had been wasted.

Both the TOWN CLERK and Alderman TOZER denied that any such sum as £50,000 had been wasted.

Mr. TERVET, on being appealed to, said that the gasholder to which Mr. Banbury and Mr. Rendle alluded as unnecessary and a waste of money, was needed. If they had not got it, they would incur great risk of the town running short of gas.

Plans are to be drawn up at Colwyn Bay for the purpose of an application for the borrowing of money for the provision of purifiers, stoking machinery, and other plant and extensions urgently needed at the gas-works.

CARLISLE GAS PROFITS.

Some particulars with regard to the past year's operations of the Carlisle Gas-Works were given to the members of the Town Council last Tuesday by Mr. Buck, who remarked that, in the first place, they had been fortunate last year in increasing the amount of gas consumed. This was a corner that they had long wished to turn. In 1906 7, they sold 301 million cubic feet of gas; in 1907-8, 290 millions; in 1908-9, 289 millions, which showed a continued decrease; but in 1909-10, the consumption went up to 304 million cubic feet. This was very largely due to the early advent of last winter. The City Treasurer reported that the income for the year had increased by £1639, which was very satisfactory, and that public lighting showed an increase of £145. Residuals were again somewhat less. Coal had cost £1431 less, and oil £963 less. The item of repair and maintenance of works and plant showed a reduction of £1524; but the Committee would remember that last year the expenditure was quite abnormal, owing chiefly to the re-sheeting of a gasholder, which cost £1268. As he had pointed out, they had been decreasing their production for a number of years until last year; but he did not think they could look for any great advance unless some method was adopted for increasing consumption. The profit for the year amounted to £5513, after they had deducted a sum of £500 to be placed to a reserve fund. The Committee hoped that this £500 would not be placed to the unappropriated balance, but would really and truly form a reserve fund for future contingencies. It was desirable that the profits of an undertaking like this should be as nearly equal from year to year as it was possible to make them—that they should not hand over everything, and have nothing to fall back upon when an occasion for large expenditure should arise, as was the case the year before last. If they could equalize the profits by some system or other, it would be desirable. Dealing with the net profit of £5513 last year, he said it was true that coal cost £1431 less than in the previous year, and oil £963 less, and they had not to re-sheet the holder at a cost of £1268, which made £3693 less than they had to pay the year before. The profit of the previous year was £464; but if they were to add to it this sum of £3693, which they had to pay less last year than the year before, they would have had a profit of £4157. Altogether, the undertaking had been very much more successful last year than it had been for many years previously, and compared with previous years last year's balance-sheet was very satisfactory. They had also an Engineer (Mr. Harold Bloor) who was in earnest in his endeavours to safeguard the interests of the Corporation in every possible manner.

DARLINGTON GAS UNDERTAKING.

Accounts for the Past Year.

The accounts of the Gas Department of the Darlington Corporation for the year ended March 31, a copy of which has reached us from the Engineer and Manager (Mr. Frank P. Tarratt), show that the sale of 337,117,596 cubic feet of gas produced £34,378; that residuals brought in £14,221; and that the total revenue was £50,964. The expenditure on the manufacture of gas was £19,763; on purification, &c., £796; wages came to £4087; repairs cost £3734; distribution, £5738; rates and taxes, £2266; management, £1540; and sundry items brought up the total to £39,064. The balance carried to profit and loss account was £11,900; and with the amount brought forward, there was produced a total of £17,223. This has been disposed of as follows: Liquidation of loans, £4208; interest on loans, £2659; transferred to district fund in aid of rates, £4500; transferred to reserve account, £824; net profit carried forward, £5033. The working statement shows that this sum is equal to 2s. 7·963d. per ton of coal carbonized, 3·243d. per 1000 cubic feet of gas made, and 3·582d. per 1000 cubic feet sold. The quantity of coal carbonized was 37,789 tons; and the make of gas 372,507,000 cubic feet, or 9857 cubic feet per ton. The residuals produced were: Coke and breeze, 18,357 tons 5 cwt.; tar, 351,422 gallons; ammoniacal liquor, 847,200 gallons—yielding respectively 11s. 5d., 18s. 8d., and 10s. 10½d. per ton. The capital invested in works and plant amounts to £185,976; being at the rate of £4 18s. 5d. per ton of coal carbonized, and 11s. per 1000 cubic feet of gas sold. The gross profit is 6·399 per cent. upon the total capital employed.

GAS PROFITS AT BURY.

Reporting to the Bury Gas Committee, the Auditors (Messrs. C. M. Merchant and Son) state that the profit on the past year's working was £20,132, compared with £18,469 for the previous year. Adding bank interest on the reserve fund, the amount available on the present occasion was £20,248. Interest and sinking fund charges came to £13,097, leaving a net profit of £7152, against £5721 for the twelve months before. Half of the sum available (£3576) has been transferred in aid of the rates; and the remaining half has been credited to the consumers in reduction of the price of gas for the current year.

When the minutes of the Committee which included this report came before the Town Council, Alderman Ashworth referred to the fact that the gas undertaking had made a profit considerably larger than the charges on the sinking fund. A long time ago, he said, there was a decided set against large profits being made by the Gas Committee, on the ground that practically these profits in a sense "robbed Peter to pay Paul." The profits were exclusively drawn from the consumers of gas; and in many instances large consumers were small ratepayers, while large ratepayers were small gas consumers. Consequently, an extra profit made on the charges for gas necessarily came to be most unequal and inequitable as between one ratepayer and another. In this case, by charging an extra price for gas and raising extra profit on it, they took money out of the pocket of the man who used gas more abundantly, and put it into the pocket of the man who was a large ratepayer and a smaller consumer of gas, because half the profits on gas went to the relief of the rates. There was a time—not in these degenerate days—when, on principle, the Corporation refused to allow the Gas Committee to make large profits; and the sooner this principle was adopted again, the sooner would they get into a sound condition of working. He hoped the ratepayers who were suffering in consequence of the present arrangement would keep their eyes open.

Several members, on the other hand, spoke in support of the existing practice; and the minutes were then confirmed.

TIPTON GAS-WORKS RESULTS.

In his report to the Gas Committee of the Tipton Urban District Council on the working for the year to March 31, the Auditor (Mr. J. E. Rowley) points out that the result is a net surplus, after payment of interest and instalments on loans, of £1238, as against £272 twelve months previously—or the large increase of £966. The gross sales of gas for the year amounted to £14,267, against £13,730, or an increase of £537; and after allowing for discounts and adjustments for stock, the net sales were £13,545, compared with £13,061, or an increase of £484. All residuals show a slight increase; the net total realized from this source being £177 more. The net result of the trading was a gross profit of £6067, as compared with £5079 for the previous year, or an increase of £988.

From the manufacturing statement of the Engineer and Manager (Mr. S. O. Stephenson), it is seen that the coal carbonized amounted to 10,831 tons last year, and 10,548 tons the year before; the total make of gas being 126,368,000 cubic feet (or 11,667 feet per ton), against 118,343,000 cubic feet (or 11,219 feet per ton). Of this, 1,273,000 cubic feet, or 1 per cent., was water gas, compared with 86,000 cubic feet, or 0·7 per cent., in 1909. The quantity of gas sent out from the works was 126,445,000 cubic feet, against 118,365,000 cubic feet; and of this, 110,083,475 cubic feet was sold, compared with 105,289,350 cubic feet. The amount of gas lost by leakage, condensation, &c., was 13 per cent., against 11 per cent. for the year previous. An average illuminating power of 15·58 candles was maintained.

NEATH CORPORATION GAS UNDERTAKING.

A Good Year's Work—Price of Gas Reduced.

The report of Mr. R. A. Browning, the Gas Engineer and Manager of the Neath Corporation, on the working of the gas undertaking in the past financial year, has lately been presented to the Town Council. It shows that the gross profit was £5657; being an increase of about £1000 on the amount realized in the preceding twelve months. In the carbonizing department there was a saving of upwards of £300, due to improved methods of working, though 360 tons more coal were used. The sulphate plant which the Gas Committee recommended has proved a success, and it yielded an increased profit of more than £247, with the price of sulphate remaining about as before. After paying out of the gross profits £1516 for interest on loans, the sum of £2750 has been reserved for their repayment, £1000 has been allocated in relief of the rates, and £350 carried to the suspense account—leaving a balance of £5321 on the profit and loss account. In the course of his report, Mr. Browning said that for the last two years there had been a strong feeling from all classes of consumers that the price of gas should be reduced; and, in view of the favourable results of last year's working, he recommended a reduction to the ordinary consumers from 3s. to 2s. 10d. per 1000 cubic feet, and for the prepayment consumers an increase from 22 to 24 cubic feet of gas for 1d. The Council adopted the recommendation; and the reduction will be made after the current quarter. In addition to the £1000 handed over in relief of the rates, the charge for the public lighting has been reduced by 10s. per lamp, which represents £250; so that the rates for the next twelve months will be relieved by £1250.

SOWERBY BRIDGE GAS-WORKS EXTENSIONS.

At the Monthly Meeting of the Sowerby Bridge Urban District Council, the minutes submitted by the Gas and Electricity Committee contained a recommendation "that the final scheme and plans in respect of the proposed extension and remodelling of the Sowerby Bridge Gas-Works be approved, and that the Clerk be instructed to make application to the Local Government Board for sanction to borrow £15,900 for the purpose of carrying out the work."

In proposing the adoption of the minutes, Mr. J. W. Whiteley remarked that every Gas Committee elected since he joined nine years ago had been convinced that the gas-works would have to be remodelled and put on modern lines; while at the same time they knew that it would be a suicidal policy to go in for a large scheme involving expenditure of capital, until some of the loans on the works had been paid off. The scheme submitted, if carried out, was one the town would be proud of. They stood in the position of having paid off the loan of £61,900 borrowed for the purchase of the works, thus effecting a saving of £1390 per annum; and in September next year other loans would be paid off, saving an additional £605 a year. The £15,900 proposed to be borrowed would require £991 per annum for interest and sinking fund. They supplied a population approaching 30,000; and in the coming winter they would be put in a tight corner to give an adequate supply. With the proposed new plant, they would produce 1,000,000 cubic feet per day. The figures got out by the Engineer (Mr. A. W. Bissell), based on what was being done at other works, without being too sanguine, showed that they could effect a saving of £1100, or sufficient to

pay the interest and sinking fund on the capital outlay. The proposals included new retort-benches with regenerator furnaces and stoking machinery.

After some little discussion, the minutes were adopted; only one member voting against.

TYLDESLEY-WITH-SHAKERLEY GAS UNDERTAKING.

In his third annual report to the Gas Committee of the Tyldesley-with-Shakerley Urban District Council (dealing with the year to March 31 last), Mr. H. R. S. Williams, the Manager, states that the gross profit for the year is £2818, which, after deducting £2226 paid for interest and sinking-fund charges, leaves a net profit of £591 to be added to the reserve fund, which now amounts to £1913. The capital charges are at the rate of 1s. 0·4d. per 1000 cubic feet sold. The amount of loan capital still owing at the commencement of the year was £21,720, of which £1446 was paid off during the year, leaving a loan capital still owing of £20,274. The gross profit is at the rate of 12·97 per cent. on the capital employed.

There have been 76 new services laid, and 67 repaired. As to consumption, 42,366,900 cubic feet of gas were accounted for—an increase of 733,900 cubic feet, which is equivalent to the increased consumption by prepayment meters. The ordinary meters in Tyldesley show a decrease of 233,700 cubic feet; while the quantity of gas used for cooking and power has increased by 82,200 cubic feet. In Astley there was an increase of 388,000 cubic feet, to which the ordinary and prepayment meters have each contributed about equal shares. Mr. Williams regrets to have to report that the all-round reduction in the price of gas, which came into operation in July last, has not had the effect of stimulating the consumption. Had it not been for the prepayment consumers, the consumption would have been less than the previous year. The closing of certain cotton-mills, short time, and depressed state of trade have all had their bearing on the quantity of gas used. The amount collected from prepayment meters was £1310, an increase of £54. The gas unaccounted for again reached a high figure—11·1 per cent.; but the loss per mile of main (325,460 cubic feet) is quite average. Coal cost 9·77d. per ton less than last year.

A GAS AND WATER COMPANY IN DIFFICULTIES.

Position of the Meldreth and Melbourn Gas and Water Company.

In accordance with the circular issued by Mr. J. W. Barratt, the Receiver in the above-named Company, to which reference was made in the "JOURNAL" last week (p. 146), a meeting of the creditors was held at the offices on the 12th inst. to consider the financial position of the undertaking. Only four creditors were represented, and these met the debenture-holders, who had just come to a decision in regard to the concern.

Mr. BARRATT explained that he had asked the creditors to meet him to redeem the promise he made in February last. At that time, they decided to defer taking any action, in order to give him an opportunity of reconstructing or selling the undertaking. Since then he had been continuously in negotiation with various firms and companies for the sale of the business, but without result. Among others, the Royston Gas Company and the Royston Water Company (the nearest similar concerns to the Company) were asked to purchase either the gas or the water section of the business or both; but these Companies were not disposed to do so. Messrs. Corbet Woodall and Son were also approached; and Mr. Woodall went into the matter chiefly with the desire to help him (the Receiver). The firm sent their engineer to report; and, as a consequence, they wrote saying that they could do nothing in the matter, as it must be many years before the concern could be made to pay. Mr. Woodall, however, expressed the opinion that the Royston Gas Company ought to be able to utilize the Company's system for the supply of high-pressure gas to the district. But, as a matter of fact, the Company had already said they would have to lay so many miles of unproductive main that it would not pay them. The Coalite Company had been asked to take up the gas section of the concern; but, up to the present, no reply, one way or the other, had been received from them. Under all the circumstances, there were only two courses open. They must ascertain whether they could dispose of the undertaking to the local authorities; and if they could not, they must sell it by public auction. This course had been agreed to by the debenture-holders. In any event, he did not see, in the face of the opinions expressed by the gentlemen he had mentioned, that anything could be realized for the creditors; and he doubted if the debenture-holders would see their money in full. They had to face this mournful conclusion; and it was useless to hang on in the hope that something better might happen. At present the concern was being carried on by himself with the assistance of Mr. Hope. The financial position was that they were about £11 to the bad; and either Mr. Hope or he had to put their hands into their pockets to meet current expenses.

A CREDITOR suggested whether it would not pay Mr. Hope to buy the whole concern and carry it on.

Mr. HOPE pointed out that he sold it to the Company in the first place because he found it too large a thing to manage himself.

Mr. BARRATT said that Mr. Hope was not only the original vendor, but also the largest debenture-holder and the largest shareholder. He (Mr. Barratt) did not anticipate that Mr. Hope would allow the concern to get into other hands; but that gentleman was anxious for it to come into the market, so that it could not be said that he made a bargain with the Company when it was in difficulties. In conclusion, Mr. Barratt said the time had come when the Company must go into liquidation; and as there were no assets to pay a liquidator, he supposed the matter would be left in his hands to wind up the whole thing. He suggested the creditors had better leave the matter where it was.

A CREDITOR expressed the opinion that Mr. Barratt had done all he could, and that the report of such a firm as Messrs. Corbet Woodall and Son could be accepted as final.

The other creditors concurred, and the meeting terminated.

SHEFFIELD CORPORATION WATER DEPARTMENT.

Annual Report of the General Manager.

The General Manager of the Water Department of the Sheffield Corporation (Mr. W. Terrey) lately presented to the Water Committee his report for the year ending the 25th of March. It shows that the total capital expenditure on the undertaking up to that date had been £3,517,186, compared with £2,433,518 at the corresponding period last year. The total income from all sources for the year was £170,891, or £2775 higher than that for 1908-9; and the expenses of maintenance and management amounted to £40,939. The net revenue was thus £129,952, or £2124 more than before. Deducting annuities and interest, £111,452, the net profit was £18,500—an increase of £1791. The sinking fund requires £12,473; so that the surplus for the year is £6027—an increase of £1560 compared with 1908-9. The value of the water supplied to the Health Committee without charge, for street watering, public baths, &c., was £3825. The special account relating to the sinking fund shows that the total sum provided out of revenue and appropriated for the repayment of debt to the 25th of March last, with earnings thereon, amounts to £261,278; and the available surplus on that date was £85,633.

The length of new mains laid during the year was 22 miles 534 yards; bringing up the total length to 527 miles. The average estimated population supplied within the statutory district, which covers an area of 128 square miles, was 505,034—an increase of 1·6 per cent. The Corporation also supply water in bulk to Rotherham, Doncaster, the Rotherham rural district, Handsworth, Chapeltown, and other outside areas, representing an additional population of 176,681; and making a total population of 681,715 supplied from the works of the Corporation. The number of houses served was 107,946, or an increase of 1401. The additional number of water-closets supplied was 3613, making a total of 55,960; and of baths 16,733—an increase of 1051. There are 4139 meters in use, against 4105 before. The total number of domestic and trade supplies on the 25th of March was 202,317; being an increase of 6252 new supplies laid on during the year.

The total volume of water sent from the works of the Corporation during the year, including the statutory compensation water to the Rivers Rivelin, Loxley, and Little Don, was 10,248,467,812 gallons. This was disposed of as follows: Trade purposes, by meter, 1,686,451,751 gallons; supplies in bulk to local authorities by meter, 262,949,500 gallons; statutory supplies to Rotherham and Doncaster, 947,288,000 gallons—total supply by meter, 2,896,689,251 gallons. For domestic purposes, including water supplied for extinguishing fires and waste, 2,442,537,679 gallons were delivered; making the total town supply 5,339,226,930 gallons. Adding the compensation water, 4,909,240,882 gallons, makes up the above-named total of 10,248,467,812 gallons, compared with 10,179,980,648 gallons in 1908-9. The average daily supply during the past financial year was 28,077,994 gallons, against 27,890,358 gallons in the preceding twelve months.

QUALITY OF CAMBRIDGE WATER.

Sterilization by Chlorine.

At a recent meeting of the Cambridge Philosophical Society, Professor Sims-Woodhead gave the results of his sterilization experiments on the water supplied to Cambridge. According to particulars contained in the current number of "Nature," sterilization by chlorine and chlorine compounds had given most startling results.

In a series of preliminary experiments, carried out in the laboratory, it had been found that one part of available chlorine to 2 million parts of water was sufficient to kill all non-spore-bearing bacteria of the *Bacillus coli* type, and therefore of the typhoid bacillus type, and probably also of the cholera bacillus type, within half-an-hour, even in the presence of the appreciable amount of organic matter that was necessarily added along with the cultures of *Bacillus coli*. Water to which had been added some hundreds of this bacillus per cubic centimetre was found after treatment to contain not a single living colon bacillus in 50, 60, and 100 c.c. (The unimportant spore-bearing organisms were not killed.)

Having obtained these results in the laboratory, a large experimental plant, capable of sterilizing more than 80,000 gallons of water per twelve hours, erected at Fulbourn, was used, and three sets of experiments were carried out—one being a preliminary series in which the apparatus was run at intervals as required; and then two series in which it was run for some twelve hours daily for more than a fortnight in each series. The standard of the Metropolitan Water Board, that there shall be no *Bacillus coli* in quantities of water less than 200 c.c., was taken as the one to be aimed at. In every case, however, quantities of 500 c.c. were examined; and after certain preliminary difficulties had been surmounted, water was obtained in which none of the observers could find the *Bacillus coli* in 500 c.c.

The amount of chlorine used in these experiments varied from one part in a million to one in six million parts of water. In the earlier experiments, where up to one part of chlorine in four million parts of water was used, it was thought necessary to neutralize any remaining chlorine by the addition of sodium bisulphite. After further experiments, where smaller quantities of chlorine were used, this addition was dispensed with, as the water treated, though sterile, did not retain the slightest taste of chlorine. It was suggested, of course, that water so treated might have some effect upon the human organism. All those who were working at Fulbourn drank considerable quantities of this water, and everyone who tried it accepted it as being a first-class drinking water.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The intimation that Mr. J. D. Smith, the Gas Engineer and Manager to the Stirling Gas Company, has received the appointment of Gas Manager to the Corporation of Belfast will, without doubt, be gladly received among his professional brethren. Mr. Smith has had a remarkably successful career since he first went to Stirling; and, indeed, his work before that, at Selkirk, was, though on a smaller scale, on a par with that which he has done since. He received the Stirling appointment in the summer of 1897, in succession to Mr. Peter Watson, who had held the office for many years. Just prior to Mr. Smith's arrival in Stirling, an attempt to municipalize the gas undertaking had failed—a step which was followed by the consolidation of the Company under an Act of Parliament of their own. This measure was obtained in 1898. Under the powers conferred by it, the work of remodelling the works was begun; and it was only completed about three years ago, when an installation of stoking machinery was introduced. For nearly ten years Mr. Smith was closely engaged in constructional work, all of which he designed himself. At the time he became Manager at Stirling, the Corporation were in no favourable mood towards the Company. Under Mr. Smith's management, the Company has been established on a basis much more secure than it ever occupied before; and so long as it continues to be managed as it has been, its prosperity is assured. Mr. Smith goes to Ireland with the heartiest good wishes of all who have had the pleasure of his acquaintance.

Matters in connection with the gas transfer at Kirkcaldy are assuming shape. On Tuesday a meeting of the Gas Committee of the Town Council was held, at which it was decided that the transfer should be proceeded with by way of arbitration. Mr. W. L. Macindoe, the Town Clerk and Secretary to the Gas Company, tendered his resignation as Law Agent for the town in the proceedings, and Mr. J. Prosser, W.S., of Edinburgh, was appointed in his stead. Mr. A. Silverthorne, of London, was appointed Arbiter on behalf of the Corporation. It was stated that Mr. Macindoe had also resigned his office of Secretary to the Gas Company. The annual meeting of the Company was held on Wednesday, at which Mr. A. M'Pherson, the former Manager, presided. He said the shareholders would observe from the report of the Directors that the manufacture of gas was still increasing, although there was not such a huge increase as they had been accustomed to in recent years. They could not expect to have such large increases as in the past, seeing they had the opposition of the electric light; but when they had something like a million cubic feet increase in dull times, it showed that their business was a progressive one. In connection with the proposed purchase of the undertaking by the town, it was quite evident that there was no hope of any arrangement being come to. The Town Council evidently did not mean to make a tender; and the Directors considered that they had waited long enough. They intended to take immediate steps to force arbitration. The action of the Directors was approved. Last night a special meeting of the Town Council was held, to consider the appointments of Mr. Prosser and Mr. Silverthorne. Mr. J. Wright, the Convener of the Gas Committee, explained that though the Council agreed to make the appointments, it did not debar them from making a tender to the Company. The appointments were agreed to.

The Broughty Ferry Town Council had before them on Monday evening the annual reports upon the financial affairs of the burgh. Ex-Bailie Godfrey, the Gas Convener, said that during the past year the gas sold amounted to 60,773,620 cubic feet—an increase of 2,818,220 cubic feet. The revenue derived from gas was £8345. It would be remembered that last year the price was reduced 2d. per 1000 cubic feet. This accounted for the gas revenue being less by £158 than in the previous year. It was pleasing to state that last year's reduction in price benefited the consumers to the extent of £500. The quantity of gas sold during the past year was the highest in the history of the undertaking. The next highest was in 1902, when it reached 60,105,116 cubic feet. The receipts from the sale of residual products last year amounted to £2393, as compared with £2388. Coke sold at an average reduced price of 6½d. per ton, and realized £51 less; while tar and sulphate of ammonia realized £56 more. It was interesting to know that 89 tons of sulphate were made, which was equal to a yield of 29·85 lbs. per ton of coal used—the average yield for the past three years having been 29·25 lbs. The receipts from residual products were equal to 62·10 per cent. of the cost of the coal delivered into store. Stove-rents were increased by £7. The total revenue from all sources was £10,852. The expenditure upon coal showed a decrease of £289. During the year 6680 tons were carbonized, as compared with 7881 tons in 1902, when the make of gas was practically the same. The manufacture of gas cost £5947, as compared with £6031 last year—a decrease of £84. Distribution cost £792—an increase of £483, the increase being accounted for by large sums charged to revenue account in respect of new meters, stoves, &c., purchased during the year. The total expenditure was £7639, which left a credit balance of £3212. Annuities amounted to £436; interest to £964; sinking fund to £1381; and depreciation upon gas-stoves to £269—a total of £3050. The standing charges worked out at 1s. 0·4d. per 1000 feet of gas sold, as compared with 1s. 0·67d. the previous year. The balance at the credit of the net revenue account was £688. During the past year the retort-house roof had been partially renewed; and the works generally had been well maintained out of current revenue. A retort-house governor was installed, and various other improvements were effected out of revenue. It was proposed to reduce the price of gas by 1d. per 1000 cubic feet, making it, to ordinary consumers, 2s. 9d.; to prepayment consumers, 3s. 1d.; and to retain the price for motive power at 2s. 6d. The report was adopted.

The Town Council of Dunfermline this week unanimously advanced the salary of Mr. A. Waddell, their Engineer and Manager, by £50 per annum.

In presiding at the annual meeting of the Cupar Gas Company, Limited, on Thursday, the Hon. Sheriff-Substitute Honeyman said the Directors had again to report a successful year's business, and a gratifying feature was a yearly increase in the sale of gas. As compared with the previous year, about three-quarters of a million cubic feet more gas was sold. The receipts from gas amounted to £3902, as against £3854. The Directors recommended dividends at the rate of 5 per cent. on the preference stock, and 37s. 6d. per share on the ordinary stock; and that £400 be allowed for depreciation. This was agreed to.

The Kelty Gas Company, Limited, have paid a dividend of 6 per cent., and have reduced the price of gas—to ordinary consumers, from 4s. 2d. to 3s. 10d., to prepayment meter consumers from 4s. 5d. to 4s. 2d., and for power purposes from 3s. 9d. to 3s. 5d.

In the Burntisland Gas Committee, on Monday, it was reported that the output of gas during the past year was about 22 million cubic feet—nearly a quarter-of-a-million larger than in the preceding year. The output has doubled during the past ten years. The price of gas was continued at 3s. 4d. per 1000 cubic feet.

At the annual meeting of the Stirling Gas Company, held last week, dividends as last year were declared—9s. 5d. on each £5 7s. 6d. share of original capital, and 11s. per share on £11 of new capital.

The eleventh ordinary general meeting of shareholders of the Saltcoats Gas Company, Limited, was held on Tuesday. The balance at the credit of the profit and loss account, after providing for depreciation on the works, amounted to £1585. Out of this sum, a dividend of 7½ per cent. was paid, absorbing £1200, and the balance of £385 was carried forward. The quantity of gas made was 26,800,000 cubic feet. There was an increase during the year of 35 ordinary and four prepayment meter consumers. The quantity of coal carbonized was 2589 tons, costing £1642; and the yield of gas per ton was 10,350 cubic feet. The revenue from gas was £4110—equal to 36·81d. per 1000 cubic feet made; from the hire of grillers, £2 13s.; and from rent of meters, £55. Tar and liquor realized £413, and coke £487. The total revenue of £5087 was equal to 45·54d. per 1000 cubic feet of gas made. The prices of gas were: To ordinary consumers, 3s. 4d.; to prepayment meter consumers, 4s. 2d.; and for street-lamps, 2s. 11d. per 1000.

The annual meeting of the Hawick Gaslight Company was held yesterday—Provost Melrose in the chair. The Directors reported that the sale of gas during the year had increased by upwards of 2 million cubic feet. The profit for the year amounted to £1800. In moving the adoption of the report, the Chairman said they might look forward to having as good a year as the one that had gone. No change would be made in the price of gas—2s. 3½d. per 1000 cubic feet. The Chairman's motion was adopted. The works are under the management of Mr. W. A. Smith, a brother of the new Engineer and Manager at Belfast.

On Tuesday evening, it was reported to the shareholders of the Bellshill Gas Company, Limited, that the make of gas in the past year was 31,659,000 cubic feet—an increase of 2,234,000 cubic feet. A dividend of 8 per cent., free of income-tax, was declared.

The Alexandria Gas Company, Limited, had a profit last year of £2631. A dividend of 5 per cent. was paid, and £740 was carried forward. It was agreed to reduce the price of gas to ordinary consumers from 3s. 9d. to 3s. 6d. per 1000 cubic feet, and for cookers from 3s. 2d. to 2s. 11d.

The Dumbarton Corporation have resolved to lay a new six-inch gas-main for the supply of the village of Milton, at a cost of £850, to be repaid in not more than seven years.

It was reported to the Hamilton Town Council on Tuesday that the gas accounts for the past year showed a profit of £36, which, with the balance of £2930 brought forward from the previous year, made a net balance of £2966. In arriving at the balance, £1000 had already been applied as a second instalment towards liquidating the cost of the new plant. The Manager's estimate of the profits for the current year is £4163, compared with £4294 last year.

The works of the Lauder Gas Company have been sold as a going concern to Messrs. Watson and Clarkston.

Some time ago, it was intimated that trouble had arisen at Kirkintilloch on account of the proposal of the Woodilee Coal and Coke Company to work out coal under the Corporation's gas-works. It has now been agreed that the Corporation are to purchase the coal in the two upper seams, at the price of 2s. 10d. per ton, on the understanding that the coal will be measured when the workings approach the reserved area. The Corporation have resolved to make an endeavour to procure an option from the Colliery Company to purchase further coal, if required, at the same price. The estimate of income and expenditure in the Gas Department having shown a large surplus, it has been agreed to reduce the price of gas from 2s. 2d. to 2s. per 1000 cubic feet, to abolish meter-rents, and to supply gas-cookers free. After allowing for these, there is an apparent balance of £803. In the case of prepayment meters, there will be a reduction of 1d. per 500 cubic feet of gas consumed.

Improved Church Lighting at Surbiton.—We learn from a paragraph in the "Surbiton Times" for the 8th inst. that a great improvement in the lighting of St. Mark's Church has been effected; the building having been fitted out by the Kingston Gas Company with Bland inverted incandescent gas-burners. Originally 202 burners were used; but this number has been reduced to 52, with the result that a more powerful light is given, there is less heat, and a saving of 25 per cent. in gas is secured. The illuminating power of the new burners is 4200 candles.

Gas-Works Loans at Tipton.—Resolutions have been adopted by the Tipton Urban District Council sanctioning the repayment to the Economic Assurance Society of a loan of £19,746, together with interest amounting to £71, and the re-borrowing of this sum from the Ecclesiastical Commissioners; also the obtaining from the same source of a further loan of £750 to cover the cost of certain additions to the gas-works, &c.—making the total of the new loans £20,496. Mr. Robins explained that the Council had been paying 4½ per cent. interest. The money would be re-borrowed at 3¾ per cent., and as the amount was nearly £20,000, the new loan would represent a considerable saving. The Clerk (Mr. Stockdale) mentioned that there would be a saving in annual payments of between £50 and £60; so that the gain to the ratepayers in twenty years—the period over which the new loan extended—would be more than £1000.

CURRENT SALES OF GAS PRODUCTS.

*** We learn that the Gaslight and Coke Company have given up selling their production of sulphate of ammonia on the old basis, known for so many years as "Beckton terms." They now offer only on the following basis: "A price per ton for 25 per cent. ammonia guaranteed, filled into buyers single bags, at Beckton, net cash." It is necessary to emphasize this change, as the new terms are so different (and much simpler) that buyers might otherwise think that a considerable drop had taken place, whereas that is far from being the case.

LIVERPOOL, *July* 16.

Sulphate of Ammonia.

The situation remains much as it was a week ago, for, although there has been nothing special about the demand, it has been large enough to absorb current output on the level of last week's prices. At the close, the quotations are £11 15s. per ton f.o.b. Hull, £11 16s. 3d. per ton f.o.b. Liverpool, and £11 17s. 6d. per ton f.o.b. Leith.

For delivery ahead, large inquiries have been coming from abroad, and a fair amount of business has been done at about the level of £11 17s. 6d. per ton for 1910 and £12 per ton for 1911, f.o.b. best ports. At the close, the above prices may be taken as nearest values.

Nitrate of Soda.

This article on spot is very quiet, and quotations are barely maintained at 9s. 3d. per cwt. for 95 per cent. and 9s. 6d. for refined quality, less 2½ per cent.

LONDON, *July* 18.

Tar Products.

Markets for tar products are still very dull, and prices remain practically unchanged. In pitch, business is quiet; and in nearly every case buyers expect to purchase under the market prices. Creosote is steady, and shipments abroad are fairly large. Benzols are very weak; and buyers are only willing to purchase at low prices. Crude carbolic seems to have again gone flat.

The average values during the week were: Tar, 15s. 6d. to 19s. 6d., *ex* works. Pitch, London, 33s. to 34s.; east coast, 32s. 6d. to 33s.; west coast, 31s. 6d. to 32s. 6d. f.a.s. Mersey ports. Benzol, 90 per cent., casks included, London, 6¾d. to 7¼d.; North, 6d. to 6¼d.; 50-90 per cent., casks included, London, 7¾d.; North, 7d. to 7¼d. Toluol, casks included, London, 10d.; North, 9d. to 9½d. Crude naphtha, in bulk, London, 3⅛d. to 3¾d.; North, 3⅛d. to 3¼d.; solvent naphtha, casks included, London, 1s. 3d.; North, 1s. 2½d. to 1s. 3d.; heavy naphtha, casks included, London, 11d. to 1s.; North, 10d. to 11d. Creosote, in bulk, London, 2¼d. to 2¾d.; North, 2d. to 2¼d. Heavy oils, in bulk, 2¾d. to 2¼d. Carbolic acid, 60 per cent., casks included, west coast, 1s.; east coast, 1s. 0½d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 42s. 6d., bags included. Anthracene, "A" quality, 1½d. per unit, packages included and delivered.

Sulphate of Ammonia.

New orders are scarce, and buyers are looking for lower prices. To-day London makes are quoted at £11 5s. to £11 5s. 6s. 3d.; Leith, £11 15s. to £11 16s. 3d.; Liverpool, £11 13s. 9d.; Hull, £11 12s. 6d. to £11 15s.; Middlesbrough, £11 12s. 6d. to £11 15s.

COAL TRADE REPORTS.

Northern Coal Trade.

There is rather an improvement in the demand for coal, possibly because of the decrease in the prices during the last week or two. Best Northumbrian steams are from about 9s. 10½d. to 10s. per ton f.o.b., second-class steams are 9s., and steam smalls are rather more plentiful at from about 5s. 6d. to 6s. 9d. The shipments are a little more encouraging; and the output seems to be better taken up. In the gas coal trade, the lower quotations are bringing in more orders. Where five weeks ago 10s. 3d. per ton f.o.b. was quoted for best Durham gas coals, 9s. 9d. is quoted now. For second-class, the current price is about 9s. 3d.; while for "Wear specials" 10s. 6d. is the present quotation. There are now more sales of gas coals to Mediterranean ports for delivery over the winter, and in some cases over next year at prices that range from about 16s. 3d. delivered at Genoa, up to 16s. 6d.—prices which seem to show that the current values and freights are not expected to be very materially added to. In the coke trade, prices are steadier, with gas coke rather scarce. Good gas coke is quoted from about 15s. 3d. to 16s. per ton f.o.b. in the Tyne or Wear.

Scotch Coal Trade.

Trade has been quiet; ell being particularly depressed. The only sorts in demand are small. The prices quoted are: Ell 8s. 6d. to 10s. per ton f.o.b. Glasgow, splint 9s. 3d. to 9s. 6d., and steam 9s. to 9s. 3d. The shipments for the week amounted to 322,870 tons—a decrease upon the preceding week of 36,900 tons, and upon the corresponding week of 27,545 tons. For the year to date, the total shipments have been 8,283,194 tons—an increase upon the corresponding period of 595,450 tons.

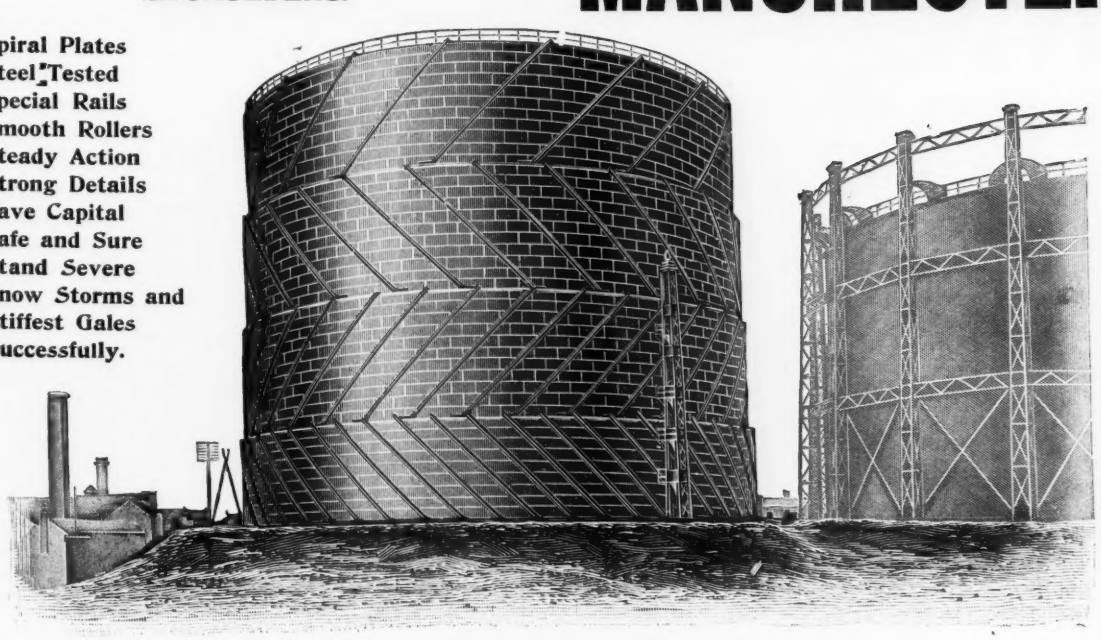
The Ilford Gas Company in the local Hospital Carnival held last Saturday week, arranged, in conjunction with the Richmond Gas Stove and Meter Company, Limited, a car entitled "Where do I come in?" A sweep with his brushes, dirty face, and untidy appearance, looking through a window at a dainty, clean girl-cook, told its own humorous and pleasing story to the quarter-of-a-million sightseers who witnessed the procession. For the last four years the Ilford Gas Company have had a different idea for their car on each occasion.

R. & J. DEMPSTER, LIMITED,

Leading Makers of SPIRAL GUIDED GASHOLDERS.

MANCHESTER.

Spiral Plates
Steel Tested
Special Rails
Smooth Rollers
Steady Action
Strong Details
Save Capital
Safe and Sure
Stand Severe
Snow Storms and
Stiffest Gales
Successfully.



From a Photograph showing the conversion of a Two-Lift Guide Framed Holder to a Four-Lift Spiral Holder of 3½ million cubic feet capacity, for the Newcastle and Gateshead Gas Company, to Plans and Specifications of W. D. GIBB, Esq., M.Inst.C.E., Engineer.

Swadlincote Gas Undertaking.

According to the annual report of the Gas Manager of the Swadlincote Urban District Council, the quantity of gas manufactured in the past financial year was 48,724,600 cubic feet, compared with 46,734,100 cubic feet in 1908-9. There was an increase of 135 cubic feet in the make of gas per ton of coal; the figures being 11,294 cubic feet last year, against 11,159 cubic feet in 1908-9. The gas consumed through ordinary meters showed an increase of 1,167,042 cubic feet; but the slot meter consumption decreased from 12,627,500 to 12,481,300 cubic feet. The total quantity sold during the year, however, showed an increase of 1,140,020 cubic feet; the respective figures being 37,221,000 cubic feet last year, and 36,080,800 feet in 1908-9. The most disquieting portion of the report is that which deals with the unaccounted-for gas, which showed an increase of 4½ per cent. upon the previous year; having gone up from 17 to 21½ per cent. On every ton of coal carbonized there was a loss by escapes of 2500 cubic feet, or, taking the whole year, a clear loss of 10½ millions. Represented in money, this loss is equal to £1950, reckoned at the rate of 3s. 8d. per 1000 cubic feet, the price charged to consumers.

Improved Public Lighting at Lowestoft.—At the last meeting of the Lowestoft Town Council, a tender was received from the Lowestoft Water and Gas Company for the supply of gas for the public services for the year ending June 24 next. The Company said they were prepared to convert all the public lamps at present fitted with flat-flame burners to incandescent lighting free of charge, and supply them and all the lamps in the borough with gas, for 2250 hours for the year, for £1 10s. per lamp. The Company will provide the necessary fittings, and clean, light, extinguish, and repair the lamps for 20s. each per annum, provided no lamp is lighted for less than three hours at a time and is lighted every night, unless it is altogether discontinued during such period as may be agreed upon. The tender was accepted.

Good Working at Marple.—At the last monthly meeting of the Marple Urban District Council, the report of the Gas Manager (Mr. J. A. K. Law) for the past financial year was submitted. It showed that the quantity of gas made was 21,869,200 cubic feet, or at the rate of 11,110 cubic feet per ton of coal. The gross profit on the undertaking amounted to £1193, out of which £488 was paid for interest and £298 was applied in reduction of debt; leaving a net profit of £407. Moving the adoption of the Gas Committee's minutes, the Chairman of the Committee (Mr. J. Smith) said the really interesting part of the report, and that which reflected the very highest credit upon the Manager, was the gas saved from leakage, which had been reduced by 420 cubic feet per ton of coal. The gas made had increased by 600 cubic feet per ton, and that sold by 1200 cubic feet per ton, which brought in £300 more profit. As Chairman of the Committee, he complimented Mr. Law on the results he had achieved, which he considered would be satisfactory to the public generally.

Reduction in Price at Leek.—The Leek Urban District Council have agreed to a recommendation of the Lighting Committee that from July 1 the price of gas to ordinary consumers be reduced to 2s. 10d. per 1000 cubic feet, subject to the usual discounts; and that in the case of prepayment meters, the discount be at the rate of 5d. per 1000 cubic feet instead of 3d.

Charge for Street Lighting at Holsworthy.—A discussion took place at the meeting of the Holsworthy District Council yesterday week with reference to the cost of street lighting. The Gas Company offered to do the lighting for £2 per lamp—an advance of 12s. 6d. per lamp on last year. Several members opposed the increase; but Mr. Kivell, the Chairman of the Company, said they could not undertake the lighting for less than the sum named. Last year a great deal of work had been done at the Company's charge to oblige the Council, including the extension of the mains in several directions. It was eventually decided to accept the Company's terms.

Cairo Water Supply.—For nearly three years the question of water supply in Cairo has been under consideration; and the Government have at length arrived at a definite conclusion. It will be remembered that in 1903 it was decided to obtain the water from deep wells at Rod-el-Farag, instead of from the Nile. Subsequently numerous complaints arose as to the quality of the new water, and the native population evinced a very strong feeling in favour of the direct supply from the Nile. The whole subject was submitted to a Committee, who, after experiments and deliberations lasting over nearly eighteen months, recommended that, subject to proper precautions being taken as regards intake and filtration, the wells should be abandoned, and water taken from the river. The Government approved these recommendations; and they have now arranged with the Water Company to revert to the river supply, under conditions as regards intake and filtration laid down by the Public Health Department.

Sale of Stocks and Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards offered for sale, by order of the Directors, £10,000 of "D" capital water stock of the Barnet District Gas and Water Company, ranking for a maximum dividend of 7 per cent. equally with the Company's existing "D" capital, which has for some time received dividends at the rate of £5 5s. per cent. per annum. It was all sold at from £117 to £118 per £100 of stock. On the same occasion, they sold some gas and water shares under instructions from executors. A few fully-paid additional ordinary £10 shares (7 per cent.) in the Lowestoft Water and Gas Company, carrying 5¼ per cent. dividend, fetched £11 10s. to £11 12s. 6d. each; 200 new £10 ordinary 5 per cent. shares in the Southend Water Company, bearing 4½ per cent. dividend, realized £10 2s. 6d. to £10 7s. 6d. apiece; some original consolidated stock and new ordinary stocks of the Southend Gas Company (both 5 per cent., but entitled to 5¾ per cent.) fetched £118 to £120 per £100 in the former case, and £117 10s. per £100 in the latter; and 500 new ordinary "B" stock in the same Company, carrying £5 7s. 6d. per cent., realized £110 10s. per £100.

THE
"MAIN"
Collapsible
PLATE-RACK,
with Adjustment to fit
various sizes of
Cookers.

— PATENTED. —

R. & A. MAIN, LTD.,
LONDON, GLASGOW & FALKIRK.

Bucks and Oxon Gas Company.—A meeting of the debenture holders and creditors of this Company was held last Tuesday, under the presidency of Mr. G. Montagu White, the Liquidator and Receiver. After dealing with the figures, Mr. White stated that there was no chance of the assets that had come into his hands paying the debenture holders. The assets in the Company's last balance-sheet were put down at £65,000; but he had made an affidavit that they would not exceed £20,000. He thought there was every need for a proper investigation, and he suggested that a petition for compulsory liquidation should be presented to the Court. A resolution to this effect was passed, after one large creditor had uttered some strong criticism in regard to the promotion of the Company. Referring to the position of the Company, the "Daily Mail" last Thursday said: "By many investors gas and water debentures are regarded as a sound investment of the highest class; and those of the big companies generally are. But the case of the Bucks and Oxon and the cases of other small gas companies which have been before the public of late point the moral that there are gas companies and gas companies, just as there are banks and banks, and brokers and brokers."

Overlapping Local Authorities.—An unusual incident occurred at a Local Board inquiry recently held by Mr. F. H. Tulloch at East Stonehouse. One subject was an application by the East Stonehouse District Council for a loan of £734 for water-works. The district is supplied with water in bulk by the Plymouth Corporation; and among those who attended the inquiry were Mr. F. Howarth, the Water Engineer to the Plymouth Corporation, and Mr. E. Foster, from the office of the Town Clerk. These gentlemen stated that they were present in accordance with a notice of the inquiry which had been sent to the Corporation. Mr. R. R. Rodd, the Clerk to the East Stonehouse Council, however, objected to their presence and to their being heard. The Plymouth Corporation, he said, had no *locus standi*; and he had informed the Town Clerk of this. He had added, as an act of grace, the information that the loan was required solely for the purpose of renewing existing mains and appliances. The Inspector thought there was very little in the objection, but that as the Local Government Board had notified the Plymouth Corporation of the inquiry, the officials had better remain. Mr. C. H. Trounce then gave evidence as to the object of the loan; and, in reply to Mr. Howarth, said that nothing was contemplated which would interfere with the Plymouth connections or with the Government supply now derived from Plymouth. Mr. Howarth explained that Plymouth had no desire to interfere with the internal arrangements of East Stonehouse. Mr. Rodd said they accepted this assurance.

We have received the "Directory of Manufacturers of, and Dealers in, Engineers' and Contractors' Machinery and Supplies," published by "Engineering Record" at No. 239, West Thirty-Ninth Street, New York.

The steel ascension pipes at the new Antwerp Gas-Works, referred to and illustrated on p. 102 of last week's issue of the "JOURNAL," are Mannesmann weldless steel tubes, 8-inch bore, No. 4 gauge, flange and spigot. There are 162 of them in all. A similar installation of 360 Mannesmann weldless steel ascension pipes (8-inch bore) was put in last year by the Alliance and Dublin Consumers' Gas Company.

Mr. J. C. Moon, the Manager of the Vancouver (B.C.) Gas Company, Limited, lately organized a series of cookery lectures and an exhibition of gas appliances in the city, with the idea of popularizing the Company, and giving everyone an idea of what it is possible to accomplish with the aid of gas. The lectures were naturally highly appreciated; and the possibilities of the modern gas-range are now better understood in Vancouver than was the case previously. An excellent set of photographs which we have received show that everything was arranged in a thoroughly up-to-date manner; and the excellence of a gaslight exposure is evidence of the admirable quality of the lighting.

Mr. Palin, addressing the Bradford City Council, complained that while the Electricity Department had been canvassing for consumers in Tong, they had been doing nothing in Tyersal and Thornbury. If, he said, they would only sell electricity in these districts at a slight reduction on the price of gas, they would secure a lot of consumers, and they would be doing a good thing for the Corporation. Alderman Robinson, in reply, remarked that the Electricity Committee would be very pleased to help the Corporation with reference to these outdistricts. If the necessary mains could be laid, he, for one, would be prepared to sell electricity at a very cheap rate indeed, in order to compete with the Gas Companies.

APPLICATIONS FOR LETTERS PATENT.

15,910.—ESHELBY, G. H. S., "Incandescent burners." July 4.
15,923.—GRAHAM, J., A., JUN., & D. A., "Reducing valves." July 4.
15,960.—SIEMENS AND HALSKE AKT.-GES., "Water-meters." July 4.
15,970.—FABRIK FÜR ROTATIONS COMPRESSOREN "SYSTEM MORELL" G.M.B.H., "Pumping liquids or gases." July 4.
15,972.—LANGE, A. R., and KRAUSE, A., "Heating and lighting in connection with fluid combustible." July 4.
16,047.—HUMMEL, H. J. J., "Incandescent gas-lamps." July 5.
16,068.—STILL, W. M., AND SONS, LTD., and STILL, E. H., "Incandescent gas-lamps." July 5.
16,095.—RILEY, C. W., "Gas cooking-stoves." July 6.
16,193.—COLLIN, F. J., "Manufacture of sulphate of ammonia from moist gases." July 6.
16,215.—LYALL, W. A., and DAVIES, J., AND SON, LTD., "Measuring the velocity of flow or pressure of gas or other fluid." July 7.
16,318.—GIDDINGS AND DACRE, LTD., and SMITH, F., "Gas-lamp smoke-bell holders." July 8.
16,322.—PUGH, F., "Gas signs." July 8.
16,349.—RUPPERT, H., "Lighting burners." July 8.
16,352.—ATKINSON, T. N., "Regulating the pressure of gas to incandescent burners." July 8.
16,390.—HARSANT, H., "Combined gas and air burner and incandescent mantle." July 9.

MAUGHAN'S

TREASURE

GEYSER

FITTED WITH

SAFETY GAS VALVE AND COLD WATER TAP.

A New Low-Priced "Chamber Heating" Pattern, delivering Water suitable for drinking, at any temperature to Boiling.

PRICE

WITH GAS TAP AND PILOT ONLY

£3 7s. 6d.

AS ILLUSTRATED

£5 0s. 0d.

May we send you full Particulars?

THE

PARKINSON STOVE CO., LTD.

(Incorporating Maughan's Patent Geyser Co.),

Stour Street, Spring Hill, BIRMINGHAM,

AND

129, HIGH HOLBORN, LONDON.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

Payable in advance. If credit is taken, the charge is 25s. a year.

Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Telegrams: "GASKING, LONDON." Telephone: P.O. 1871a Central.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

DRAUGHTSMAN. Melbourne Metropolitan Gas Company. Applications by July 29 to J. Terry and Co., 7, Great Winchester Street, E.C.

DRAUGHTSMEN. W. J. Jenkins and Co., Retford.

LABORATORY ASSISTANT. No. 5263.

REPRESENTATIVE. "Gas Works," c/o Streets, Cornhill.

Situations Wanted.

IN GAS OR WATER CONCERN. No. 5265.

MANAGER OR SECRETARY, &c. No. 5267.

Gas Works, &c., for Disposal.

TARPORLEY GAS-WORKS. Tenders by Aug. 2.

Business for Disposal. No. 5266.

Plant (Second-Hand) for Disposal.

OLD PLANT. Aldershot Gas, Water, and District Lighting Company.

PURIFIERS, &c. Oldbury Gas Department.

STEAM ENGINES, &c. Johnson, New Hythe.

WASHER-SCRUBBER. Newark Gas Company.

Meetings.

SOUTH METROPOLITAN GAS COMPANY. De Keyser's Hotel, Aug. 10, Two o'clock.

SOUTH SUBURBAN GAS COMPANY. De Keyser's Hotel, Aug. 5, Three o'clock.

TOTTENHAM AND EDMONTON GAS COMPANY. Gas-Works, Aug. 6, Three o'clock.

Patent Licence.

LIGHTING AND EXTINGUISHING DEVICE. H. Haddan and Co., Bedford Street, Strand, W.C.

Tank-Waggon for Hire.

CLAYTON ANALINE COMPANY.

TENDERS FOR

Benzol.

WARRINGTON GAS DEPARTMENT. Tenders by July 28.

Coal and Cannel.

CRANLEIGH GAS COMPANY. Tenders by July 25.

HAWORTH URBAN DISTRICT COUNCIL. Tenders by July 25.

MARKET HARBOROUGH GAS DEPARTMENT. Tenders by July 23.

OLDHAM GAS DEPARTMENT. Tenders by July 26.

RADCLIFFE AND PILKINGTON GAS COMPANY. Tenders by July 26.

STRETFORD GAS COMPANY. Tenders by Aug. 3.

Coke (Wanted). No. 5264.

Gasholder and Tank.

EVESHAM TOWN COUNCIL. Tenders by July 25.

Retort Stack and Mountings.

DOUGLAS GASLIGHT COMPANY. Tenders by July 29.

Roofs.

DOUGLAS GASLIGHT COMPANY. Tenders by July 29.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 174.

Issue.	Share.	When ex Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,474,000	Stk.	Apl. 1	5	Alliance & Dublin Ord.	81–83	..	6 0 6
310,000	Stk.	Jan. 13	4	Do. 4 p.c. Deb.	100–102	..	3 18 5
200,000	5	May 12	7	Bombay, Ltd.	6⅞–6⅞	..	5 9 10
40,000	5	,,	7	Do. New, £4 paid	4⅝–5⅛	..	5 9 3
50,000	10	Feb. 25	15	Bourne- mouth Gas and Water } 10 p.c.	29–30	..	5 0 0
311,810	10	,,	7	B 7 p.c.	16½–16⅝	..	4 3 7
75,000	10	,,	6	Pref. 6 p.c.	15–15⅜	..	3 17 5
380,000	Stk.	,,	12½	Brentford Consolidated	251–254	..	4 18 5
300,000	,,		9⅜	Do. New	183–190	..	5 0 0
50,000	,,	Aug. 12	5	Do. 5 p.c. Pref.	120–122	..	4 2 0
206,250	,,	June 10	4	Do. 4 p.c. Deb.	99–101	..	3 19 3
220,000	Stk	Mar. 16	11	Brighton & Hove Orig.	214–217	..	5 1 5
246,320	,,	,,	8	Do. A Ord. Stk.	153–156	..	5 2 7
460,000	20	Apl. 1	16⅝	British	44–45	..	4 14 8
109,000	Stk.	Feb. 25	6	Bromley, A 5 p.c.	118–120	..	5 0 0
165,700	,,	,,	4½	Do. B 3⅛ p.c.	88–90	..	5 0 0
82,278	,,	,,	5⅜	Do. C 5 p.c.	105–107	..	5 2 10
55,000	,,	June 29	3⅛	Do. 3⅛ p.c. Deb.	85–87	..	4 0 6
250,000	Stk.	June 29	4	Buenos Ayres 4 p.c. Deb.	96–98	..	4 1 8
100,000	10	—	—	Cape Town & Dis., Ltd.	3–4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	5⅛–6½	..	—
50,000	50	May 3	6	Do. 6 p.c. 1st Mort.	49–50	..	6 0 0
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	88–90	..	5 0 0
157,150	Stk.	Feb. 25	5	Chester 5 p.c. Ord.	109–111	..	4 10 1
1,513,280	Stk.	Feb. 25	5⅝	Commercial 4 p.c. Stk.	108–110	+1	4 14 7
560,000	,,	,,	5	Do. 3⅛ p.c. do.	103–105	..	4 15 3
475,000	,,	June 29	3	Do. 3 p.c. Deb. Stk.	80–82	..	3 13 2
800 000	Stk.	June 10	5	Continental Union, Ltd.	91–94	−1⅛	5 6 5
200,000	,,	,,	7	Do. 7 p.c. Pref.	135–137	..	5 2 2
492,270	Stk.	—	5⅓	Derby Con. Stk.	121–123	..	4 9 5
55,000	,,	—	4	Do. Deb. Stk.	104–105	..	3 16 2
148,995	,,	Apl. 1	5	East Hull 5 p.c. Ord.	96–98	..	5 2 0
486,090	10	July 14	12	European, Ltd.	23⅜–24¼*	..	4 18 9
354,060	10	,,	12	Do. £7 10s. paid.	17½–18¼*	..	4 18 8
16,198,670	Stk.	Feb. 10	4⅜	Gas 4 p.c. Ord.	105–106	+½	4 8 0
2,600,000	,,	,,	3½	light 3½ p.c. max.	88–90	..	3 17 9
4,062,235	,,	,,	4	and 4 p.c. Con. Pref.	104–106	..	3 15 6
4,531,706	,,	June 29	3	Coke 3 p.c. Con. Deb.	80–82	..	3 13 2
258,740	Stk.	Mar. 16	5	Hastings & St. L. 3½ p.c.	93–95	..	5 5 3
82,500	,,	,,	6⅔	Do. do. 5 p.c.	117–119	..	5 9 3
70,000	10	Apl. 29	11	Hongkong & China, Ltd.	17–17½	..	6 5 9
131,000	Stk.	Mar. 16	7	Ilford A and C	145–147	..	4 15 3
65,780	,,	,,	5⅓	Do. B	109–111	..	4 19 1
65,500	,,	June 29	4	Do. 4 p.c. Deb.	98–100	..	4 0 0
£			p.c.				£ s. d.
4,940,000	Stk.	May 12	8	Imperial Continental	178–180	..	4 8 11
1,235,000	Stk.	Feb. 10	3½	Do. 3½ p.c. Deb. Red.	94–96	..	3 12 11
195,242	Stk.	Mar. 16	6	Lea Bridge Ord. 5 p.c.	122–124	..	4 16 9
561,000	Stk.	Feb. 25	10	Liverpool United A.	219–221	..	4 10 6
718,100	,,	,,	7	Do. B	164–165	..	4 4 10
306,083	,,	June 29	4	Do. Deb. Stk.	104–106	..	3 15 6
75,000	5	June 29	6	Malta & Mediterranean	9/16–4⅛	..	6 4 8
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	100–102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100–102	..	4 8 3
541,920	20	May 27	3⅜	Monte Video, Ltd.	12½–13	..	5 7 8
1,775,892	Stk.	Feb. 25	4⅛	Newc'tle & G'tesh'd Con	103¾–104½	+⅛	4 3 9
529,435	Stk.	June 29	3⅜	Do. 3½ p.c. Deb.	83–91	..	3 16 11
55,940	10	Feb. 25	7	North Middlesex 7 p.c.	133–133	..	5 1 10
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	138–140	..	5 14 4
60,000	5	Apl. 1	8	Ottoman, Ltd.	6½–6⅝	+⅛	6 3 1
31,800	53	Feb. 25	13	Portsea Island A.	134–136	..	5 1 0
60,000	50	,,	13	Do. B.	126–128	..	5 1 7
100,000	50	,,	12	Do. C.	119–121	..	4 19 2
114,800	50	,,	10	Do. D and E.	100–102	..	4 18 0
398,490	5	Apl. 29	7	Primitiva Ord.	7⅛–7⅜	..	4 13 4
796,980	5	June 29	5	Do. 5 p.c. Pref.	5⅛–5⅜	..	4 10 11
488,902	100	June 1	4	Do. 4 p.c. Deb.	97–99	..	4 0 10
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb.	97–99	..	4 0 10
250,000	10	Apl. 1	9	San Paulo, Ltd.	15⅞–16⅛	..	5 10 9
62,500	10	,,	6	Do. 6 p.c. Pref.	11⅞–12⅛	..	4 18 0
125,000	50	July 1	5	Do. 5 p.c. Deb.	49–50	..	5 0 0
135,000	Stk.	Mch. 16	10	Sheffield A	234–236	..	4 4 9
209,984	,,	,,	10	Do. B	234–236	..	4 4 9
523,500	,,	,,	10	Do. C	233–235	..	4 5 1
70,000	10	May 27	7	South African	11–11⅛	..	6 1 9
6,429,895	Stk.	Feb. 10	5/9/4	South Met., 4 p.c. Ord.	120⅜–122½	+⅛	4 9 2
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	79–81*	+½	3 14 1
209,820	Stk.	Mar. 16	8	South Shields Con. Stk.	157–158	..	5 1 3
605,000	Stk.	Feb. 25	5⅜	S'th Suburb'n Ord. 5 p.c.	121–123	..	4 12 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	121–123	..	4 1 4
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	120–122*	+½	4 2 0
502,310	Stk.	May 12	5	Southampton Ord.	110–112	..	4 9 3
120,000	Stk.	Feb. 10	6⅞	Tottenham A 5 p.c.	133–135	..	5 1 9
453,940	,,	,,	5⅜	and B 3⅛ p.c.	113–115	..	4 13 6
149,470	,,	June 29	4	Edmonton 4 p.c. Deb.	97–99	..	4 0 10
182,380	10	June 10	8	Tuscan, Ltd.	9–9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	97–99	..	5 1 0
236,476	Stk.	Feb. 25	5	Tynemouth, 5 p c max.	113–115	..	4 6 11
255,636	Stk.	Feb. 25	6⅞	Wands- B 3⅛ p.c.	139–141	..	4 14 0
79,416	,,	June 29	3	worth 3 p.c. Deb. Stk.	73–75	..	4 0 0

Prices marked * are "Ex div."

Price 1s. 8vo., in Stiff Paper Cover.

THE EARLIEST WORKS ON GAS LIGHTING.

A List of Books, Pamphlets, and Important References Prior to the Year 1840.

By F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E.

WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

BROTHERTON & CO., LIMITED.
Offices: City Chambers, LEEDS.
Correspondence invited.

PATENTS AND TRADE MARKS
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 & 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no back Pressure.
The Cheapest in the Market.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

"HALLITE" Asbestos High-Pressure Sheeting.
HALLITE DOUGLAS, LIMITED, 106, Leadenhall Street, LONDON, E.C.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

AMMONIACAL Liquor wanted.
CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.
Telegrams: "CHEMICALS."

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers, Works: BIRMINGHAM, LEEDS, SUNDERLAND, and WAKEFIELD.

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: SATURATORS, BOLTON. Telephone 0848.

GAS OILS.
MEADE-KING, ROBINSON, & CO.
Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 18, EXCHANGE STREET, MANCHESTER, and 11, OLD HALL STREET, LIVERPOOL.

WARNER & VAN DER BIESEN,
ZWOLLE, HOLLAND.
DIGGERS AND SUPPLIERS OF THE
FINEST DUTCH BOG-ORE.
(Natural Oxide of Iron.)
Best Percentages. For lowest Quotations to any Port, Station, or direct into Works, please apply to—
LONDON OFFICES: 6, LEATHER LANE, E.C.

W. EDGAR for:—
GAS HEATING APPARATUS—
THE BLENHEIM FIRE, &c.
BLENHEIM WORKS, HAMMERSMITH.
Telegrams: "GASOSO LONDON." Telephone: 14 HAMMERSMITH.

TAR WANTED.
Telephone: Central Manchester, 7009.
Telegrams: "UPRIGHT."
Apply, THOMAS HORROCKS,
Albert Chemical Works, BRADFORD, MANCHESTER.
Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams:—
"BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

OXIDE OF IRON (BOG ORE).

ANY QUANTITY. ANY PORT. ANY STATION.
DONALD M'INTOSH,
110, CANNON STREET, LONDON.

DUTCH OXIDE OF IRON.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

THE First Dutch Bogore Co., Ltd.,
NYMEGEN, HOLLAND.
General Manager (for England and Wales)—
CHARLES E. FRY, LEAMINGTON,
General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

AMMONIACAL Liquor wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, SUNDERLAND, AND WAKEFIELD.

D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS,
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "DACOLIGHT LONDON." Telephone: 2336 HOLBORN.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the *best*. Satisfaction Guaranteed.

LUX'S GAS PURIFYING MASS.
See Advertisement on First White Page.
FRIEDRICH LUX, LUDWIGSHAFEN-AM-RHEIN.

BRISTOL RECORDING GAUGES AND THERMOMETERS.
J. W. & C. J. PHILLIPS, 28, COLLEGE HILL, LONDON, E.C., and 25, BRIDGE END, LEEDS.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
It is also used for the enrichment of Gas.
Manufactured and supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agent, F. J. NICOL, Pilgrim House, NEWCASTLE-ON-TYNE.
Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

IT is Worth Your While to Buy Direct.
The RELIANCE LUBRICATING OIL COMPANY supply the best value in NON-CORROSIVE LUBRICANTS—viz, Motor Waggon Oil, 1s.; Motor Car Oil, 2s.; Engine, Cylinder, and Machinery Oils, 1s.; Axle Oil, 10½d; Exhauster Oil, 10d.; Special Cylinder Oil, 1s. 4d.; 650 T Cylinder, 2s.; Special Engine Oil, 1s. 4d.; Gas Engine and Oil Engine Oil, 1s. 6d.; Refrigerator, 1s. 9d.; Renown Engine Oil, 11½d.; and Astral Disinfectant, 2s. 6d. per gallon. Barrels free, carriage paid. Solidified Oil, 25s. cwt.
THE RELIANCE LUBRICATING OIL COMPANY, 19 & 20, Water Lane, Tower Street, LONDON, E.C.

KRAMERS AND AARTS WATER-GAS PLANT.
K. & A. WATER-GAS COMPANY, LTD.
89, VICTORIA STREET, S.W.

AMMONIA.
Consumers in any form are invited to correspond with CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.

AMMONIA Waste Liquor Disposal.
Purification Plant.
Results Guaranteed. No Working Costs.
JOHN RADCLIFFE, Chemical Engineer, EAST BARNET.

J. E. C. LORD, Ship Canal Tar Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

OXIDE OF IRON.

(NATURAL.)
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS.
BALE & CHURCH,
5, CROOKED LANE, LONDON, E.

SULPHURIC ACID.

SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.
with which is amalgamated WM. PEARCE & SONS, LTD.
86, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341 AVENUE.

F. BOYALL, Contractor for Painting GASHOLDERS, OIL-TANKS, ROOFS, and all kinds of LOFT and other PAINT WORK.
70, Balcorne Street, Well Street, HACKNEY, N.E.

READ HOLLIDAY AND SONS, LTD.,
HUDDERSFIELD,
Are prepared to Supply
BENZOL, TOLUOLE, NAPHTHA, AND CREOSOTE
in large Quantities.
ENQUIRIES SOLICITED.

SPENCER'S PATENT HURDLE GRIDS.
THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, June 21, p. 914.

SULPHURIC ACID.

SPECIALLY prepared for Sulphate of AMMONIA Makers by
CHANCE AND HUNT, LIMITED,
Works: OLDBURY, WEDNESBURY, AND STAFFORD.
Address Correspondence and Inquiries to OLDBURY, WORCS.
Telegrams: "CHEMICALS, OLDBURY."

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
FIRTH BLAKELEY, SONS, AND COMPANY, LIMITED, Thornhill, DEWSBURY.

CORRESPONDENCE CLASSES.
GAS Engineering and Gas Supply.
City and Guilds of London Institute.
Teacher: HERBERT LEES (Silver Medallist), Assoc.M.Inst.C.E., Engineer and Manager of the Hexham Gas Company, Lecturer at Rutherford College, Newcastle-on-Tyne.
For Terms, &c., address ELVASTON ROAD, HEXHAM.

AN experienced Water-Works Manager and Secretary requires an Appointment in either Capacity. Would not object to a small Water-Works, or to Act as PRIVATE SECRETARY to an Engineer or Professional Gentleman, also willing to Travel as Representative for any Manufacturers of Water-Fittings, Meters, Pressure Gauges, &c.
Address No. 5267, care of Mr. King, 11, Bolt Court FLEET STREET, E.C.

GENTLEMAN, for some Years Connected with a Water Company now absorbed by Municipality, SEEKS OCCUPATION with either a Gas or Water Concern. Thoroughly Acquainted with the whole of the Official Work, Registration, Accounts, and Rating. Good Organizer. Excellent Testimonials and References as to Abilities and Character. Small Initial Salary accepted with prospect of advance on work proving satisfactory.
Address No. 5265, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ROBERT DEMPSTER & SONS, Ltd.,
Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Boss Mount Iron-Works, Elland.

GAS TAR wanted.
Brotherton and Co., Ltd., Tar Distillers. Works: Birmingham, Glasgow, Leeds, Liverpool, Sunderland, and Wakefield.

DRAUGHTSMEN—Wanted two Practical Men Experienced in Gas-Works Plants, Coal and Coke Handling Plants, &c.
Apply, stating Age, Experience, and Salary, to W. J. Jenkins and Company, Limited, Engineers, Retford.

REPRESENTATIVE required to introduce and push important article used in all Gas-Works. Must have Good Connections and be good Salesman.
Please write, stating Qualifications, District, and References, to: "Gas-Works," care of Streets, 30, Cornhill, E.C.

WANTED by a Firm of Ironfounders and Chemical Engineers, with Established Trade among Chemical Manufacturers, to undertake the Sole Rights of Making and Selling Chemical Specialities in Great Britain.
Apply No. 5262, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

OWING to Promotion, a Gas Company in Yorkshire require the Services of a Young Man to ASSIST IN THE LABORATORY.
The Candidate must have had Practical Experience in the Photometer, and in making the ordinary Tests of Liquor, Furnace Gases, &c.
Apply, by letter, stating Age, Experience, and Salary required, to No. 5263, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

METROPOLITAN GAS COMPANY OF MELBOURNE, VICTORIA.

DRAUGHTSMAN required, must be thoroughly Experienced in Gas-Works Construction and Designing of Plant, accustomed to Setting-out Work, and Qualified to Take Charge of Drawing Office. Experience in the Supervision of Construction a recommendation. Knowledge of the Design of Reinforced Concrete an advantage.
Salary, £300. Passage Paid.
Apply, in first instance, by letter only (not later than July 29), giving full Particulars of Qualifications, Age, and present Salary, to John Terry and Co., 7, Great Winchester Street, E.C.

GASHOLDERS—Splendid 45 feet diameter and New STEEL TANK, fixed Complete to Plan and Specification; also 14 feet and 16 feet Diameter GASHOLDERS, with STEEL TANKS. Can be seen temporarily erected. Re-erected Cheap for immediate Sale.
Firth Blakeleys, Thornhill, Dewsbury.

FOR HIRE—One Tank-Waggon suitable for carrying Benzol, and one suitable for carrying Crude Naphtha.
Address The Clayton Aniline Company, Limited, Clayton, Manchester.

OLD Plant, &c., For Sale, Ash Road, Aldershot, Farnborough, Hartley, Wintney, and Odiham Gas-Works.
Printed Schedule on Application to the General Manager, Aldershot Gas, Water, and District Lighting Company, Victoria Road, Aldershot.

FOR SALE—Kirkham's Patent "Standard" WASHER-SCRUBBER, with ENGINE for driving same.
Capacity, 350,000 cubic feet per twenty-four hours. 12-inch Connections. Cost £314.
For Price and further Particulars, apply to the Newark Gas Company.

FOR Disposal—10-H.P. Portable Steam-ENGINE, practically new, by Marshall and Sons, Gainsborough, insured by National (90 lbs. pressure). 4-H.P. Horizontal STEAM-ENGINE, 5-H.P. Horizontal STEAM-ENGINE BOILER TANK, ¼ in. Plate, capacity 3070 gallons, absolutely sound. Cheap. Stationary STEAM CRANE, long jib. Offers Solicited.
W. Johnson, Junr., New Hythe, Kent.

FOR immediate Sale—A Private Manufacturing Business. Splendid Connection, and Business still Increasing. Excellent opportunity and bargain, especially for a Traveller or Firm Dealing with Gas Companies, Ironmongers, &c. Lowest price, £250 (cash down). If preferred, a WORKING PARTNERSHIP could be arranged at half price.
Apply, No. 5265, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

RADCLIFFE AND PILKINGTON GAS COMPANY.

TENDERS FOR COAL AND CANNEL.

THE Directors invite Tenders for a Twelve Months' Supply of GAS COAL and CANNEL.
Particulars may be obtained from the undersigned, by whom Tenders will be received until Tuesday, the 26th inst.
James Braddock,
Manager and Secretary.
Gas Offices, Radcliffe,
July 12, 1910.

TENDERS are invited for a Twelve Months' Supply of Screened GAS COKE for a large Engineering Works in the Midlands (name will be disclosed on Application).
Approximate total Quantity, 725 Tons. Delivery to be taken as required.
Address No. 5261, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

THE Directors of the Cranleigh Gas and Coke Company, Limited, invite TENDERS for the Supply of 950 Tons of Good GAS COAL, to be delivered Carriage Paid Cranleigh Station (London Brighton and South Coast Railway), as ordered by the Secretary over the Ten Months, Sept. 1, 1910, to June 30, 1911.
Tenders to be sent not later than midday on Monday, July 25, under cover, marked "Coal," to the Secretary, Cranleigh Gas and Coke Company, Limited, Cranleigh, Surrey.

THE Haworth Urban District Council are prepared to receive TENDERS for the Supply of 2500 Tons of GAS COAL (Screened, Unscreened, and Gas Nuts) delivered at the Haworth Station during the ensuing Twelve Months. Sealed Tenders, endorsed "Gas Coal Tender," to be forwarded to me, the undersigned, not later than the 25th inst.
No Special Form of Tender.
William Robertshaw,
Clerk to the Council.
1, Burlington Chambers,
North Street, Keighley.

DOUGLAS GASLIGHT COMPANY.

THE Gas Company are prepared to receive TENDERS from Experienced Contractors for the Erection of RETORT HOUSE ROOF and COAL STORE ROOF, RETORT STACK, and RETORT STACK MOUNTINGS, at the Gas-Works, Douglas.
The Drawings and Specification may be seen at the Gas-Works or at the Offices of the Engineers, Messrs. Thomas Newbigging and Son, 5, Norfolk Street, Manchester. A copy of the Bill of Quantities may be obtained from the Engineers on Deposit of One Guinea, which will be returnable on receipt of a *bonâ-fide* Tender.
Sealed Tenders, endorsed "Cast-Iron and Steelwork Contract No. 2," to be addressed to the undersigned on or before the 29th day of July, 1910.
The Company do not bind themselves to accept the lowest or any Tender.
Charles H. Kay,
Secretary and Manager.
Gas Offices, Douglas,
July 14, 1910.

STRETFORD GAS COMPANY.

THE Directors of the Stretford Gas Company invite TENDERS for the Supply of Unscreened GAS COALS, NUTS, SLACK, and CANNEL, to be Delivered at the Gas-Works, Stretford, on the Bridgewater Canal, or at Stretford Station (M. S. J. & A. Railway) during the next One, Two, or Three Years, according to the printed Conditions, commencing Sept. 1, 1910.
Tenders to be delivered to the Gas-Works, Stretford, not later than noon on Wednesday, the 3rd of August, 1910, endorsed "Coal," and addressed to the Chairman.
The Directors do not bind themselves to accept the lowest or any Tender.
Forms of Tender and Conditions can be obtained on Application to the undersigned.
By order of the Board,
H. Kendrick,
Engineer and Manager.
Stretford, July 15, 1910.

MARKET HARBOROUGH URBAN DISTRICT COUNCIL.
(Gas Department.)

TENDERS FOR GAS COAL.

THE Gas Committee invite Tenders for the Supply of the whole or part of 4500 Tons of Best Screened GAS COAL and NUTS, to be delivered during the Year ending June 30, 1911, at the London and North Western or Midland Railways Station, Market Harborough.
Conditions and Form of Tender may be obtained from the undersigned, to whom Sealed Tenders, endorsed "Tenders for Gas Coal," must be delivered not later than Saturday, the 23rd inst.
The lowest or any Tender not necessarily accepted.
Alfred T. Harris,
Manager and Secretary.
Gas Offices, St. Mary's Road,
Market Harborough, July 8, 1910.

BOROUGH OF EVESHAM.

THE Evesham Town Council are prepared to receive TENDERS for the Provision and Erection of a SINGLE-LIFT GASHOLDER IN A STEEL TANK ON THE GADD AND MASON SPIRAL-GUIDED Principle, to be erected on a site situate at their Gas-Works in the Borough of Evesham.
Copies of the Drawings and Specifications, together with all other necessary Particulars, may be obtained on Application to Mr. Percy H. Fletcher, Gas-Works Manager and Engineer, Gas-Works, Evesham, on payment of the sum of One Guinea, which will not be returned.
The Contractor whose Tender is accepted will be required, at his expense, to enter into a formal Contract with the Town Council for carrying out the work, and also a Bond with two approved Sureties, for the due and proper Performance of the Contract, such Documents to be prepared by me.
Sealed Tenders, marked "Tender for New Gasholder and Tank," to be delivered or sent by post to me at my Offices not later than Monday, the 25th day of July inst.
The Town Council do not bind themselves to accept the lowest or any Tender.
Thos. A. Cox,
Town Clerk.
Town Clerk's Offices,
Evesham, July 7, 1910.

THE Warrington Corporation Gas Department invite TENDERS for 2000 to 5000 Gallons of BENZOL for Delivery during the next Twelve Months.
Tenders to be sent in not later than the 28th inst.
Further Particulars may be had on Application to Mr. W. S. Haddock, Engineer, Gas-Works, Warrington.
Fredk. Taylor,
Secretary.
Gas Offices, Warrington,
July 15, 1910.

COUNTY BOROUGH OF OLDHAM.

THE Gas-Works Committee invite TENDERS for the Supply of GAS COALS during a period of Nine Months commencing the 1st of October, 1910.
Conditions and Forms of Tender may be obtained on Application to Mr. A. Andrew, Gas Offices, Oldham, to whom Tenders are to be delivered not later than Tuesday, July 26, 1910.
By order,
J. H. Hallsworth,
July 7, 1910. Town Clerk.

URBAN DISTRICT COUNCIL OF OLDBURY.
(Gas Department.)

THE Gas Committee of the above Council are open to receive TENDERS for the PURCHASE of Six 15 feet square by 5 feet deep PURIFIERS, with 10-inch Valves, Bye-Passes, Connections, and Travelling Lifting Apparatus, all Complete and in Good Condition, replaced by larger Plant.
Further Particulars may be had on Application to the undersigned.
The Gas Committee do not bind themselves to accept the highest or any Tender.
By order,
A. Cooke,
General Manager.
Gas-Works, Oldbury,
July 4, 1910.

EUROPEAN GAS COMPANY, LIMITED.

SHARE WARRANTS TO BEARER.

NOTICE is Hereby Given, that, in accordance with a Resolution passed at the ANNUAL GENERAL MEETING of Shareholders held on the 12th inst., a Dividend and Bonus of Fourteen Shillings per share will be payable on and after the 30th inst., on the above Shares, subject, however, to a deduction of 1s. 1d. per share for French Stamp and Transfer Duty.
Payment will be made at the Union of London and Smith's Bank, Limited, Princes Street, London, E.C., after Serial Coupon No. 71 has been left Three clear days for Examination.
W. B. Brady,
Secretary.
Finsbury House, Blomfield Street,
London, E.C., July 13, 1910.

SOUTH METROPOLITAN GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at De Keyser's Royal Hotel, Victoria Embankment, in the City of London, on Wednesday, the 10th day of August next, at Two o'clock in the Afternoon precisely, to receive the Directors' Report and the Accounts of the Company for the Half Year ended the 30th of June last; to declare a Dividend for the same period; and to consider a recommendation of the Directors to increase the Remuneration of the Secretary.
Notice is Hereby also Given, that the Directors will submit a Resolution to the Proprietors for the purpose of authorizing the Sale of certain lands, which are no longer required for the purposes of the undertaking.
The TRANSFER BOOKS WILL BE CLOSED from the 27th day of July inst. until after the Meeting.
By order,
F. M'Leod,
Secretary.
Offices: 709, Old Kent Road, S.E.
July 16, 1910.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the ANNUAL ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at the Gas-Works, Willoughby Lane, Tottenham, on Saturday, the 6th day of August next, at Three o'clock in the afternoon precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ending June 30, 1910; to declare Dividends; to elect Two Directors and an Auditor for the ensuing Year; and to transact General Business.
The TRANSFER BOOKS for the "A" and "B" CONSOLIDATED STOCKS WILL BE CLOSED from July 23 to Aug. 6, both days inclusive.
By order of the Board,
E. Topley,
Secretary.
Chief Offices of the Company
639, High Road, Tottenham,
July 15, 1910.

SOUTH SUBURBAN GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the De Keyser's Royal Hotel, Victoria Embankment, London, E.C., on Friday, the 5th day of August, 1910, at Three o'clock in the Afternoon precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ended the 30th of June last; to declare a Dividend for the same period; and for General Purposes.
The TRANSFER BOOKS WILL BE CLOSED from the 22nd day of July until after the Meeting.
By order of the Board,
Charles M. Ohren,
Offies and Works: Secretary.
Lower Sydenham, S.E.,
July 18, 1910.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to MESSRS. A. & W. RICHARDS, at 18, FINSBURY CIRCUS, E.C.

GAS-WORKS, FREEHOLD LAND, AND COTTAGES AT TARPORLEY, CHESHIRE.

FOR SALE BY TENDER

THE Tarporley Gaslight and Coke Company, Limited, all that Freehold plot of Land situate at Tarporley, in the County of Chester, together with the Gas-Works erected thereon and known as

THE TARPORLEY GAS-WORKS,

and also as a Going Concern, the Business carried on by the said Company as from the 30th day of September, 1910, with the DISTRIBUTING PLANT including MAINS, SERVICES, METERS, COOKERS, and such of the CONSUMERS' FITTINGS as are the property of the Company; and also the benefit of all Pending Contracts and Engagements entered into by the Company.

And also all those FOUR FREEHOLD COTTAGES adjoining situate and Numbered 3, 5, 9, and 11, Eaton Road, Tarporley, aforesaid. Gross rentals £34 9s. per Annum.

Tenders to be sent, under cover and sealed, to the Vendors' Solicitors, on or before the 2nd day of August, 1910.

The Vendors do not bind themselves to accept the highest or any Tender.

Forms of Tender and of the Conditions upon which such Tender is received and further Particulars may be obtained at the Offices of the said Company, Eaton Road, Tarporley, or Messrs. THOS. SMITHURST and Co., Chartered Accountants, 26, Pall Mall, MANCHESTER, or Messrs. RICHARD HIGHAM and Co., Vendors' Solicitors, 49, Princess Street, MANCHESTER.

AUTOMATICALLY LIGHTING AND EXTINGUISHING GAS FROM A DISTANCE, No. 9392, OF 1908.

THE Patentee is desirous of arranging, by LICENSE or otherwise, on Reasonable Terms, for the Manufacture and Commercial Development of the Invention in this Country.

Address, HERBERT HADDAN AND CO., Patent Agents, 31-32, Bedford Street, Strand, LONDON, W.C.

Bound in Cloth. Octavo, 174 pp. Price One Guinea.

PRECEDENTS
IN
Private Bill Legislation
AFFECTING
GAS AND WATER UNDERTAKINGS
1891-1901.

COMPILED BY
EDMUND HERBERT STEVENSON, M.Inst.C.E., F.S.I.,
and
EDWARD KYNASTON BURSTAL, M.Inst.C.E., M.I.Mech.E., F.G.S.

[The Volume for 1879-1890 is still on sale.]

LONDON
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

HEATHCOTE GAS COAL
from the
GRASSMOOR COLLIERIES,
CHESTERFIELD.

Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

ALL the
BOYS CALORIMETERS
which have been in daily use in all the Official Testing-Stations in London for the last Three Years
WERE MADE BY
JOHN J. GRIFFIN & SONS,
— LIMITED —
KINGSWAY, LONDON, W.C.
Those desiring to obtain **Gas Calorimeters** as used in the **Official Testing Places** should see that the apparatus bears the name of the Original makers.
Descriptive Catalogue on Application.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

BIRTLEY IRON COMPANY,
ESTABLISHED 1820,
Owners of the Birtley Iron Works and Pelaw Main Collieries,
GENERAL ENGINEERS & IRONFOUNDERS.

Makers of Cast-Iron PIPES and CONNECTIONS for Gas, Water, Steam, Electrical, Sanitary, and other purposes; also TANKS, COLUMNS of every description, Hydraulic, Gas, and Colliery PLANT, &c.

Illustrated Catalogue, giving complete list of our manufactures, on application.

Works: BIRTLEY, CO. DURHAM.
Newcastle-on-Tyne Offices: MILBURN HOUSE.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER
Gas Engineers' Agents and Contractors for METERS, FIRE-CLAY GOODS, OXIDE OF IRON AND ALL OTHER GAS APPARATUS.
Inquiries Solicited.
Telegrams: "DARWINIAN, MANCHESTER," Telephone 1806.

MIRFIELD GAS COAL.
UNEQUALLED.
Sperm Value 878·85 lbs. per Ton.

Please apply for Price, Analyses, and Report, to the
MIRFIELD COLLIERY COMPANY,
RAVENSTHORPE, NEAR DEWSBURY.
LONDON: 16, Park Village East, N.W.

KOPPERS' PATENT
CHAMBER OVENS.

Results obtained which have never been Surpassed by any other System of Carbonization.

Plants at Work and under Construction for the production of **18,000,000** cubic feet of Gas per Day.

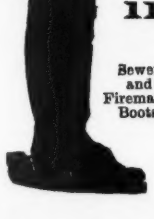
See our large Advertisement appearing in alternate issues of the "JOURNAL."

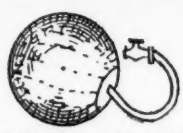
The KOPPERS'
COKE OVEN AND BYE-PRODUCT CO.,
301, Glossop Road, SHEFFIELD.

CAST-IRON PIPES FOR GAS, WATER, & STEAM,
also VALVES of all descriptions.
R. LAIDLAW & SON, LTD.,
ALLIANCE FOUNDRY, 147, MILTON STREET, **GLASGOW,**
And LAMBHILL FOUNDRY, **GLASGOW.**
OFFICE: 147, MILTON STREET, **GLASGOW.**

GEORGE WILSON, COVENTRY.
Wet and Dry Gas Meter Manufacturer.
PREPAYMENT METERS for Pennies, Shillings, or any other Coin.
Sole Agent for Scotland: DANIEL MACFIE, 1, North St. Andrew Street, EDINBURGH.

Telegrams: "Airproof, London."
THOMAS BUGDEN & CO.,
Telephone: 743 City.
India-Rubber and Airproof Manufacturers and General Contractors,
116-118, GOSWELL ROAD, LONDON, E.C.
Largest Manufacturers of Gas Main Bags.


Sewer and Fireman's Boots.


Gas Bags for repairing Mains. All Seams Stitched and Taped.

Patentees of the DENMAR BAG,
Impervious to Main Liquor and Climatic Influences.
Oilskin Clothing, Diving and Wading Dresses, Sewer Boots, Tar Hose, Stokers' Mitts, Bellows, &c.

Gas Bags for repairing Mains. All Seams Stitched and Taped.

Contractors' and Miners' Jackets.

THE LADDITE MANTLE

"the Star of the Mantle World," still **holds the field** for Strength and Light, as users have proved for themselves. The Company have recently quadrupled their powers of production to meet the great demand. **Facts speak for themselves.**

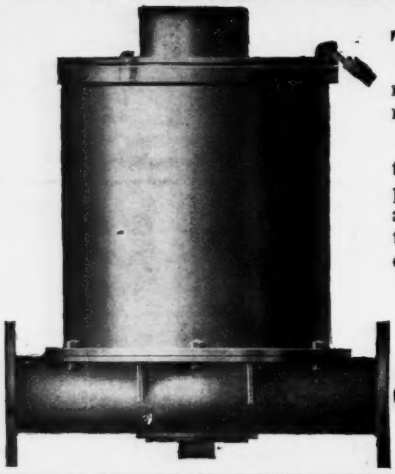
The Company are now prepared to negotiate large contracts, and guarantee prompt deliveries.

AWARDED GOLD MEDAL, FRANCO-BRITISH EXHIBITION.

General Offices and Works:

THE LADDITE INCANDESCENT MANTLE CO., LTD., PENRHYN ROAD, KINGSTON-ON-THAMES.

HIGH PRESSURE MERCURIAL GOVERNOR



THIS Governor has been specially designed to work on high pressure mains, where these have been adopted, to effect the necessary reduction from the high pressure in the main to the low pressure required for normal working.

It can be supplied to suit any desired range of pressures; for example, the standard size reduces from 5 lbs. inlet pressure to ordinary low pressure. At the same time the Governor is correctly compensated and so accurately adjusted that, in the event of the main being temporarily used for low pressure distribution, it will work as an ordinary low pressure governor.

SIZES AND PRICES ON APPLICATION.

JAMES MILNE & SON, LIMITED,

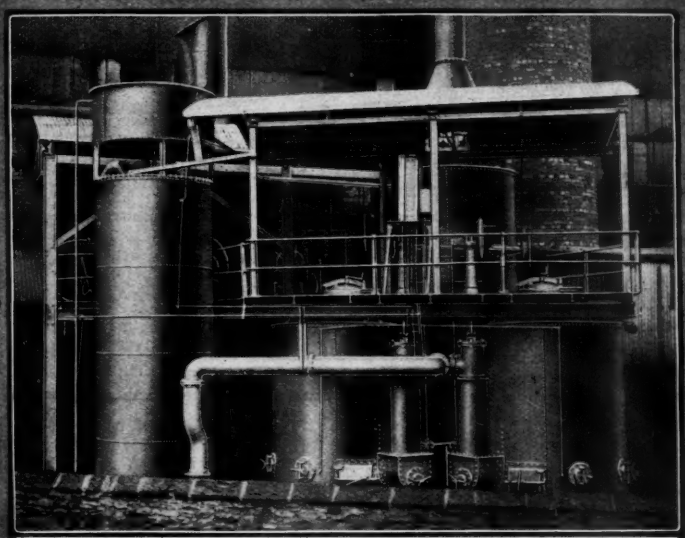
EDINBURGH. LONDON. GLASGOW. LEEDS.

CLAYTON, SON & Co LTD LEEDS

MAKERS OF

"K&A" WATER GAS PLANTS

COMPLETE INSTALLATIONS FOR "BLUE" OR "CARBURETTED" WATER-GAS



HIGHEST EFFICIENCY GUARANTEED

THE PLANT FOR MINIMUM DEPRECIATION

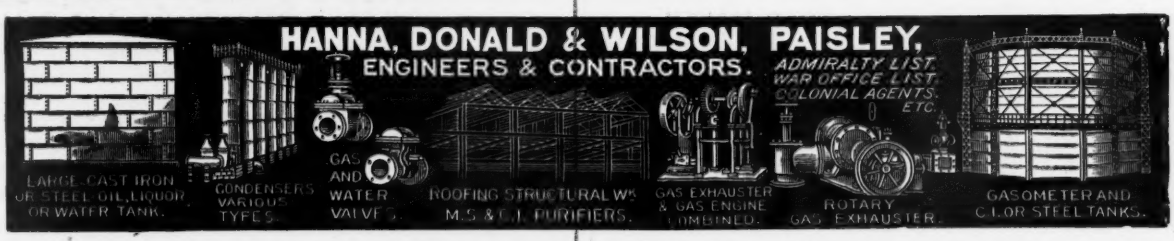
500,000 CUBIC FEET PLANT INSTALLED & WORKING SUCCESSFULLY AT HUNSLET, LEEDS

THE WIGAN COAL & IRON CO., LIMTD.,

Are the exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, Wigan, and of the Manton Steam and House Coal Collieries, Worksop, Notts, and supply the well-known Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, House and Steam Coals, &c.

MIDLAND AND WEST OF ENGLAND DISTRICT OFFICE: *6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.*
Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone: No. 200.

LONDON DISTRICT OFFICE: *6, STRAND, LONDON—C. PARKER & SON, Sole Agents.* Telegraphic Address: "PARKER, LONDON."


HANNA, DONALD & WILSON, PAISLEY,
ENGINEERS & CONTRACTORS.
ADMIRALTY LIST.
WAR OFFICE LIST.
COLONIAL AGENTS.
ETC.
LARGE CAST IRON OR STEEL OIL, LIQUOR OR WATER TANK.
CONDENSERS VARIOUS TYPES.
GAS AND WATER VALVES.
ROOFING STRUCTURAL WK M.S. & C.I. PURIFIERS.
GAS EXHAUSTER & GAS ENGINE COMBINED.
ROTARY GAS EXHAUSTER.
GASOMETER AND C.I. OR STEEL TANKS.

Workmanship and Materials of the Highest Quality.

PECKETT'S LOCOMOTIVES.

Built to any Specification or Gauge.

PECKETT & SONS,
ATLAS LOCOMOTIVE WORKS, BRISTOL.

JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of

ALDWARKE MAIN, CAR HOUSE, & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

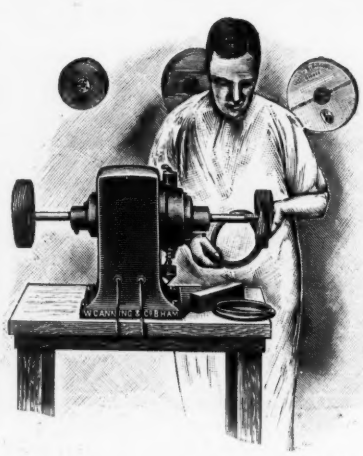
ALDWARKE MAIN GAS COAL

Analysis: 12,600 Feet of 19-Candle Gas per Ton.
Value in Pounds of Sperm, 820·20.

VERY FREE FROM IMPURITIES.

TELEGRAMS: "ATLAS SHEFFIELD."

FOR POLISHING AND CLEANING



GAS COOKERS

AND

BRASS GAS FITTINGS

WRITE TO

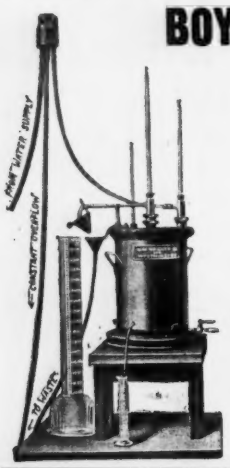
W. CANNING & Co.,

BIRMINGHAM,

OR ST. JOHN'S SQUARE, CLERKENWELL, LONDON,
for Catalogue "G4."

Actual Manufacturers of Machinery and Materials for Polishing and Lacquering.

Our Goods are used by all the Leading Manufacturers. Goods Specially Packed for Export.



BOYS' CALORIMETER

AS USED IN THE

LONDON TESTING STATIONS.

Certified if Desired.

LOWER PRICE THAN ANY OTHER MAKER.

MADE BY

ALEXANDER WRIGHT & CO. LTD.

WESTMINSTER.

PROFESSOR DR. STRACHE,

Wassergas-u. Patentverwertungs-Gesellschaft, m.b.H.

Alserstr. 71. **WIEN.** Alserstr. 71.

PROJECTS AND INSTALLATIONS OF WATER-GAS-PLANTS

On the Strache System.

STEAM-CONTROLLER for Water-Gas-Plants
RAISES the Calorific Value up to 3000 Calories.
REDUCES the CO_2 Contents to 2 per cent.
INCREASES the Capacity of the Unit-Time.
DIMINISHES the Steam Consumption.
INCREASES the Yield.

AUTOLYSATOR
Apparatus for Use in Heating-Plants of All Kinds, registering continuously and visibly the CO_2.

GASOSCOPE
Apparatus serving to Find out the Leakage in Gas-Mains.

Representative for England:—G. PETTIGREW, THORNABY-ON-TEES, ENGLAND.

"TATSAL"

Is synonymous with "Strength" in

CIRCULATORS AND GAS-FIRED STEAM BOILERS.

Manufactured by

W. BRIGGS,

5, LAMBETH HILL, LONDON, E.C.

SILICA MACHINE MADE RETORTS.

TRADE "C.O." MARK. REGISTERED.

THE NEW RETORT

Will withstand high temperatures and is **Guaranteed not to Contract or Soften** under Heat.

GREATER CONDUCTIVITY THAN ANY FIRE-CLAY RETORT.

For Particulars and prices apply—

JOSEPH MORTON, LTD.,

Cinder Hills Fire Clay Works,

Telegrams: "MORTON, HALIFAX." ESTABLISHED 1783. *Tel. No. 134.* **HALIFAX.**

London Agents: DOW & WILSON, 32, Fenchurch Street, LONDON, E.C.

CASES FOR BINDING QUARTERLY VOLUMES OF THE "JOURNAL"

PRICE **2s.** *EACH.*

ADDITIONAL REVENUE FOR GAS-WORKS.

COKE SELLING . . AT 11/6 A TON
COALEXLD SELLING AT 20/- A TON
IN THE SAME TOWN.

X

COALEXLD, LIMITED.
LANCASTER.

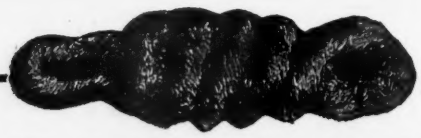
SPECIAL ROTARY METER.

For Coke Oven Gas.
For Blast Furnace Gas.
For FOUL GAS.

Particulars on application to—

T. G. MARSH,

28, Deansgate, MANCHESTER.



LEAD WOOL

Is sent out in Skeins all ready for use.
Every Skein of equal weight and length.
The Lead Wool Joint is built up evenly all the way through.
Lead Wool requires no melting and can be used in water without risk.

Lead Wool Joints are Twice as Strong as Cast Lead Joints and cost 33⅓ per cent. less.

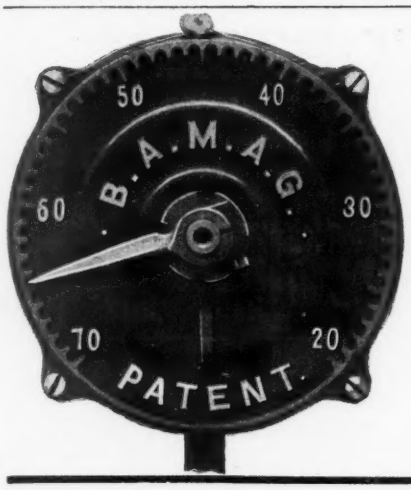
THE LEAD WOOL CO., LTD., SNODLAND, KENT.

Telegrams: "STRENGTH, SNODLAND." Telephone 199 SNODLAND.

CLAYTON SON & CO LIMITED

Pepper Rd. Branch, Hunslet, Leeds.

Interior View of Works Employed in the Manufacture of WELDED STEEL MAINS for WATERWORKS Etc.



OVER 59,500 IN OPERATION

(INCREASE SINCE LAST YEAR **19,500**)

SUITABLE FOR ALL PRESSURES AND ALL CONDITIONS.

SUITABLE FOR ALL BURNERS, UPRIGHT OR INVERTED.

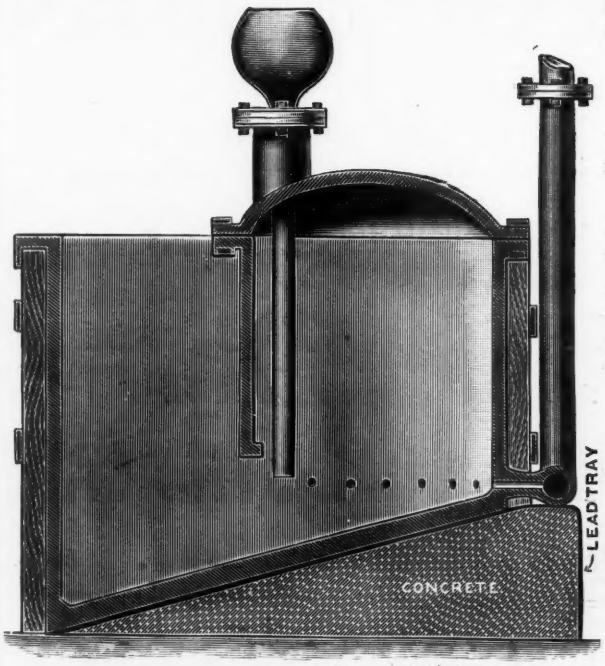
Full Particulars on Application to

DISTANCE LIGHTING Co.

69 Farringdon Road LONDON E.C.

Telephone: Holborn 2139. Telegrams: "DISTANCING LONDON."

SULPHATE OF AMMONIA PLANT



Section showing Williams and Fenner's Patent Outside Cracker Pipe as fitted to our Solid Lead Plate Saturator.

Williams' and Fenner's Patent Saturator with Outside Cracker Pipe, having the following

ADVANTAGES:—

1. **Equal distribution of Steam and Ammonia.**
2. **Perfect agitation and boiling of the Acid Liquor.**
3. **No possibility of local Alkalinity.**
4. **Consequently no formation of Blue Salt.**
5. **Sulphate is easily forced to point of discharge.**
6. **No incrustation.**
7. **No renewals of Cracker Pipe.**
8. **Capacity of output greatly increased.**

IT CAN BE APPLIED TO ANY EXISTING SATURATOR.

LICENCES TO MAKE MAY BE OBTAINED.

For full Particulars apply to the Sole Proprietors

BIGGS, WALL & CO.

13, Cross Street, Finsbury Pavement,

LONDON, E.C.

Telegrams: "RAGOUT LONDON." Telephone: 273 CENTRAL.

Rheinische Chamotte-und Dinas-Werke, Cologne on Rhine.

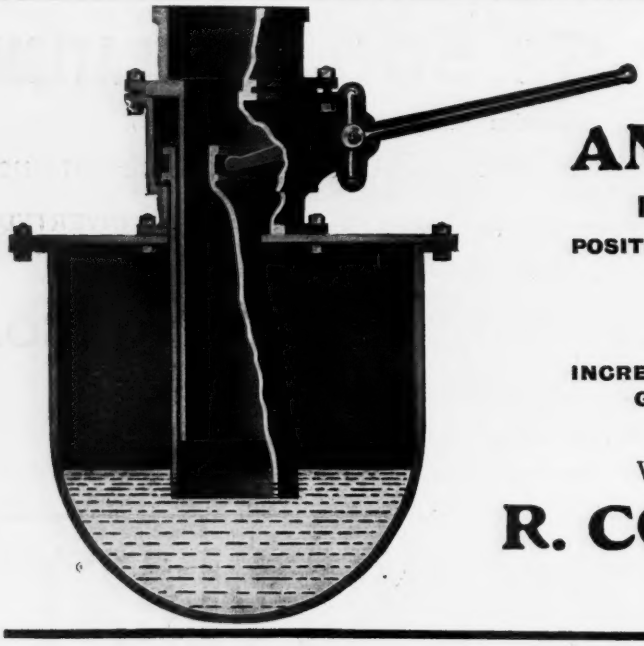
Construction of

Entire Gas-Works & Coke Oven Plants,

Retort Furnaces,

Furnaces for Chamber Settings (*Patent*), New Coke Ovens (*Patent*),

With and without Recovery of the Bye-Products, Tar and Benzol Distilleries, Ammonia Works, and Cyanogen Extraction Plants.



CORT'S
PATENT
ANTI-DIP VALVE.

IMPORTANT POINTS:—

POSITIVE IN ACTION,
ABSOLUTELY SAFE,
ALWAYS FULL BORE.

WE GUARANTEE

INCREASED MAKE PER TON,
GREATER ILLUMINATING POWER,
SATISFACTION, &c.

Write for fullest Particulars to—

R. CORT & SON, Ltd.,
READING.

SMOKELESS COAL.

The British Coalite Company having failed in their proceedings against us, we are now prepared to grant **Licenses,** both **at Home and Abroad,** on Reasonable Terms, to Corporations, Gas Companies, and others, for the Manufacture under our Patents of

SMOKELESS COAL, GAS, BYE-PRODUCTS, &c.

By our methods, results superior to other processes can be obtained.

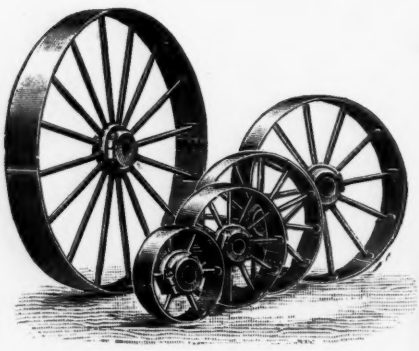
THE SCOTTISH SMOKELESS COAL SYNDICATE,
116, Hope Street, GLASGOW.

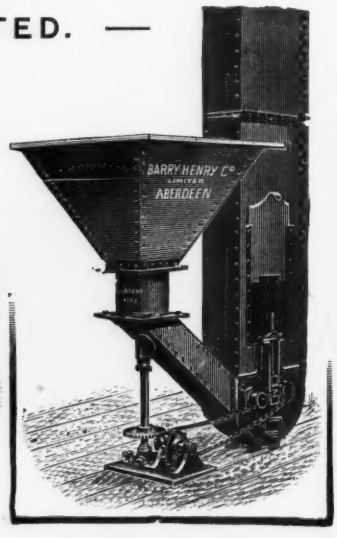
BARRY, HENRY, & CO.,

— LIMITED. —

Specialities:
TRANSMISSION OF POWER.
Rope & Belt Pulleys,
Spur & Bevel Wheels,
Shafting & Couplings,
Pedestals & Fixings.

WORKS:
ABERDEEN,
SCOTLAND.





Specialities:
TRANSMISSION OF MATERIALS.
Conveyors,
Elevators,
Grinding Machinery,
Motors.

AND
64, MARK LANE,
LONDON, E.C.

Welsbach LIGHT

Inverted Arc Lamp, Fig. 623.

Storm Proof—

For Exterior Lighting.

Welsbach-Kern

(Patent) Inverted System

BRITISH MADE.

BRITISH MADE.

Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 4 ins.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 5 ins.
3-light . . .	1 ft. 5 ins.
4-light . . .	1 ft. 8 ins.

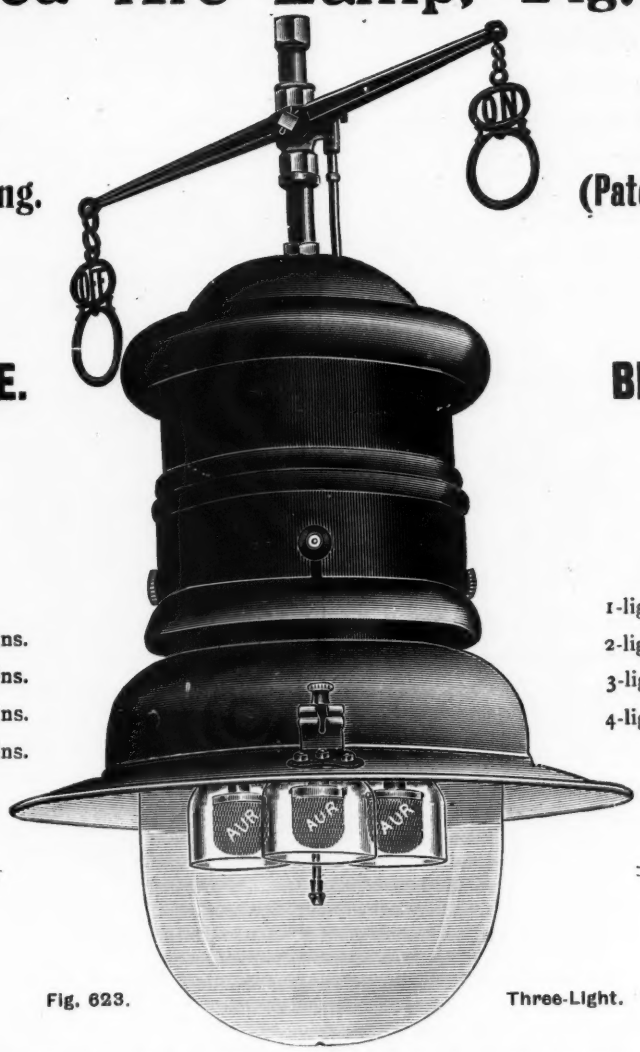


Fig. 623. Three-Light.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

	Gas per hour.	*C.P.*	*Steel.*	*Copper Case.*		*Gas per hour.*	*C.P.*	*Steel.*	*Copper Case.*
1-light	4 feet	125	**30/-**	**5/-** extra.	3-light	12 feet	400	**52/6**	**6/-** extra.
2-light	8 feet	260	**47/6**	**6/-** extra.	4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

RENEWALS.

Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Clear Glass Globes, each	**2/3**	**5/9**	**5/9**	**9/-**
„ „ „ In Case lots per dozen.	**19/6**	**57/9**	**57/9**	**93/-**
Case contains . .	*80*	*18*	*18*	*12*

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Wired Globes, extra each	**2/-**	**2/-**	**2/9**	**3/6**
Parabolic Reflector, extra „	**3/6**	**6/-**	**7/6**	Not made

Welsbach Mantles, each **6d.** subject as usual.

The Welsbach Mantles for Upright lighting are "C," "CX," and "Plaissetty," price **4½d.** each.

THE WELSBACH INCANDESCENT GAS LIGHT CO., LTD.,

Welsbach House, 344-354, Gray's Inn Road, London, W.C.

Telegrams and Cables: "WELSBACH LONDON." *Telephone: 2410 NORTH.*

GAS WORKS APPLIANCES, TOOLS, &c.

HULETT'S

Coke Barrows.
Forks and Shovels.
Service Cleansers.
Pressure Gauges.
Gas and Liquor Valves.
Cotton Waste, Yarn.
Syphon Pumps.
Street Lanterns.
Main Laying Tools.
&c., &c.

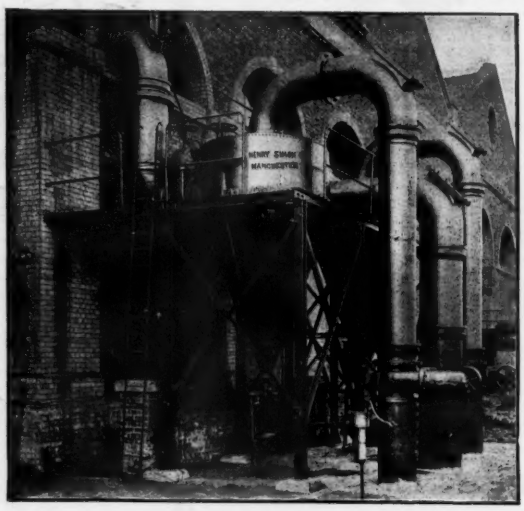
See Special Catalogue No. 153.

D. HULETT & CO., LTD.

Gas Engineers.

55 & 56, High Holborn, LONDON, W.C.

Established 1818.



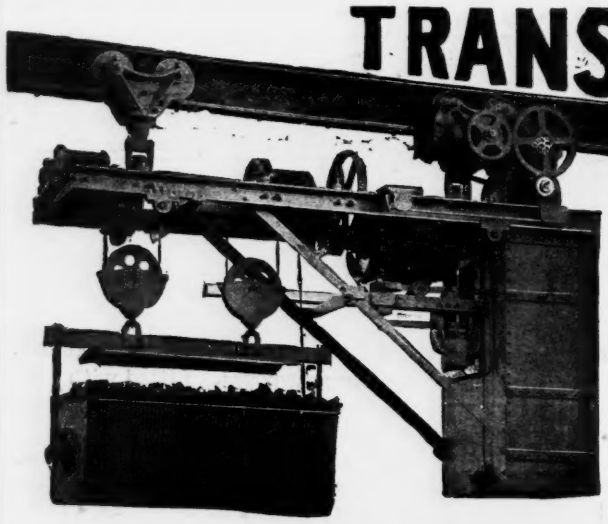
"CYCLONE"
TAR EXTRACTOR.

No Steam.
No Moving Parts.
No Power.

HENRY SIMON, LTD.,

20, Mount St., Manchester.

TRANSPORTERS FOR



Coal and Coke

etc., etc.

Large Installations

now
at work and
on order.

WRITE FOR PARTICULARS TO—

W. J. JENKINS & CO., Limited,

ENGINEERS, RETFORD, NOTTS.

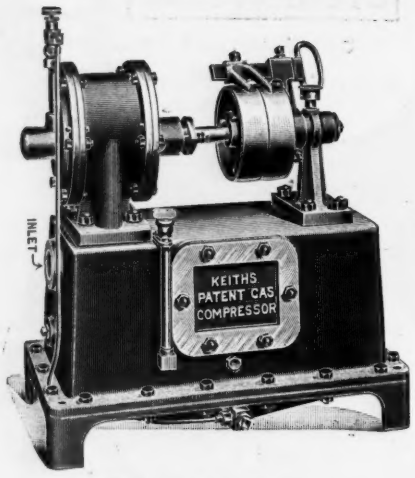
MECHANICAL
COAL
HANDLING
PLANTS
OF ANY MAGNITUDE
MADE AND ERECTED
BY
GIBBONS
BROTHERS
LTD
DUDLEY & LONDON

GEO. K. HARRISON LTD.
STOURBRIDGE
CONTRACTORS
TO
THE CHIEF GASWORKS
IN THE BRITISH ISLES
AND ABROAD.
FOR
MANUFACTURED FROM
OUR
CAREFULLY SELECTED
AND
WELL SEASONED STOCK
OF
OLD MINE FIRE CLAY.
RETORTS

DRAKES LIMITED
PATENT TUBE
REGENERATOR FURNACES
HALIFAX.

The KEITH LIGHT.

OVER 6000 INSTALLATIONS NOW IN USE.



Rotary Compressor.

60-CANDLE POWER PER FOOT.

Sizes from

100 c.p. to 1500 c.p.

500 to 1500 c.p. Outside Lamp.

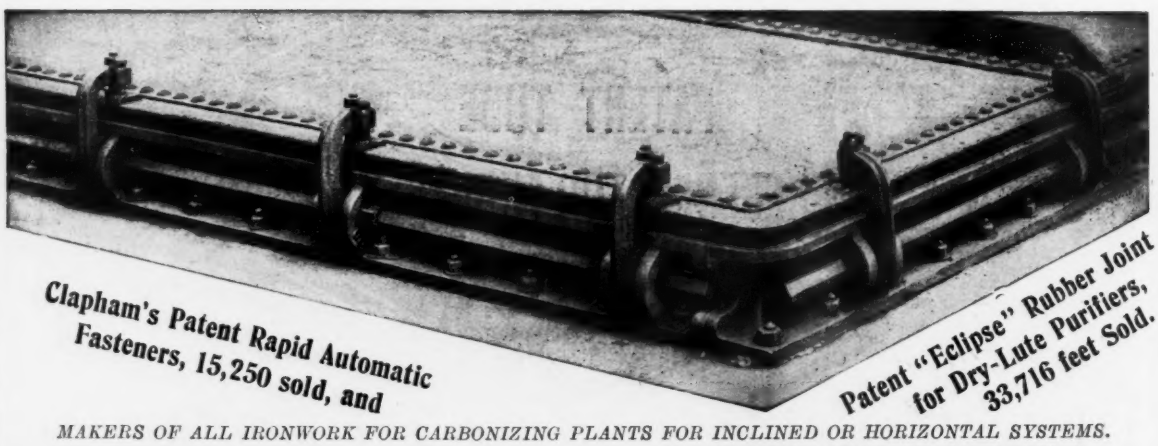
JAMES KEITH AND BLACKMAN CO., LTD.,

27, Farringdon Avenue, LONDON, E.C.

CLAPHAM'S SPECIALITIES

Awarded Diploma of Honour, Franco-British Exhibition.

Retort Mouthpiece, Improved Livesey-Washer, Clapham's Patent P. & A. Extractor, Ball Washer-Scrubber with Speed-Reducing Gear and Engine, Valves, Finish in Castings, and



Clapham's Patent Rapid Automatic Fasteners, 15,250 sold, and

Patent "Eclipse" Rubber Joint for Dry-Lute Purifiers, 33,716 feet Sold.

MAKERS OF ALL IRONWORK FOR CARBONIZING PLANTS FOR INCLINED OR HORIZONTAL SYSTEMS.

CLAPHAM BROS., LTD.,

Wellington, Nelson, and Market Street Works,
KEIGHLEY, YORKS.
London Representative: THOMAS B. YOUNGER, C.E., 30, Queen Anne's Chambers, Westminster, S.W.
Scotch Representative: JNO. D. GIBSON, 2, Causeyside Street, Paisley.
West of England Representative: F. HERBERT STEVENSON, 14, New Street, Birmingham.

Printed and Published by WALTER KING, at No. 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, July 19, 1910.